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Missouri River Basin WATER RESOURCES MANAGEMENT PLAN

A Comprehensive, Coordinated Joint Plan for Water and Related Land Resources And Final Environmental Impact Statement

Adopted May 1980

Missouri River Basin Commission

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The Missouri River Basin Commission is the principal agency for the coordination of Federal, State, interstate, local, and nongovernmental plans for the development of water and related land resources in the area served by the Missouri River and its tributaries. As an independent regional commission, it also provides a forum in which States meet with Federal agencies to conduct and coordinate water and related land resources planning. The Commission Chairman is appointed by the President; its Vice Chairman is elected from among State members.

MRBC members are Colorado; Iowa; Kansas; Minnesota; Missouri; Montana; Nebraska; North Dakota; South Dakota; Wyoming; Department of Agriculture; Department of the Army; Department of Commerce; Department of Energy; Environmental Protection Agency; Federal Emergency Management Agency; Department of Health and Human Services; Department of Housing and Urban Development; Department of the Interior; Department of Transportation; Yellowstone River Compact Commission; Big Blue River Compact Administration. Canada and Missouri River Basin Indian Tribes are observers.

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MISSOURI RIVER BASIN
WATER RESOURCES MANAGEMENT PLAN

A Comprehensive, Coordinated Joint
Plan for Water and Related
Land Resources Development, Management, and Conservation
and
Final Environmental Impact Statement

Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Adopted May 1980

ACKNOWLEDGEMENT

The Missouri River Basin Water Resources Management Plan was authorized by the Commission under Public Law 89-80 and was prepared under the direction of the Commission's Planning Committee. The members of the Planning Committee during the preparation of the plan were:

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PREFACE

This report presents the water and related land resources management plan for the Missouri River Basin. The plan was prepared through the joint efforts of the 23 State, Federal, and interstate members of the Missouri River Basin Commission as well as numerous other water resource agencies. Chapter 11 contains the final environmental impact statement on the plan, which was prepared in accordance with the National Environmental Policy Act of 1969.

The purpose of the plan is to serve as a definitive yet flexible guide for the development, conservation, preservation, and management of water and related land resources in the Missouri River Basin. Because the findings in the plan are the product of extensive interagency and interstate cooperation and collective judgment, they are a reliable guide for programming and budgeting for all levels of government. The recommendations are intended to support the Congress, the Federal Government, and States in programming, budgeting, and funding water resources programs and projects in the Missouri River Basin.

The Commission has prepared a separate plan for each of eight subbasins in order to facilitate both the preparation and presentation of the plan. Also included is a set of basinwide and statewide recommendations which should be considered and used in close conjunction with any of the subbasin plans.

The Commission's first basinwide plan was presented in a report published in August 1977 titled Missouri River Basin Water Resources Plan. Since this is an update of the 1977 plan,

descriptive material presented in this report is summarized. Persons interested in obtaining more detailed desciptive information should consult either the 1977 report of The Missouri River Basin Comprehensive Framework Study, published in 1971 by the Commission's predecessor agency, the Missouri Basin Inter-Agency Committee. More information about the specific conclusions and recommendations presented in this report is available from the Missouri River Basin Commission.

The Commission's planning process is intended to be flexible and responsive to changing conditions, needs, and policies. The conclusions and recommendations presented in this report are therefore subject to change at any regularly scheduled Commission meeting.

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CHAPTER 1

INTRODUCTION

BACKGROUND AND AUTHORITY

The first comprehensive water resources study for the Missouri River Basin was conducted by the Missouri Basin Inter-Agency Committee prior to the establishment of the Missouri River Basin Commission. The report on the study was published in December 1971. This seven-volume report, The Missouri River Basin Comprehensive Framework Study, presented the results of the first effort in the Missouri River Basin to assess and address the major current and future water resources needs and opportunities of the entire basin.

The Missouri River Basin Commission was established in 1972 under the authority of the Water Resources Planning Act of 1965 (P.L. 89-80), which states in part that each river basin commission shall:

> Serve as the principal agency for the coordination of Federal, State, interstate, local, and nongovernmental plans for the development of water and related land resources in its area, river basin, or group of river basins; and prepare and keep up-to-date, to the extent practicable, a comprehensive, coordinated, joint plan for Federal, State, interstate, local, and nongovernmental development of water and related land resources...

The Commission began preparing its first basinwide water resources management plan in 1975 in an effort coordinated with

the Commission's participation in the U.S. Water Resources Council's 1975 National Water Assessment. A report summarizing the plan, titled Missouri River Basin Water Resources Plan, was published in August 1977.

The Commission's planning process is continuous, producing an ever evolving and responsive plan of action for the Missouri River Basin. However, the Commission also perceives a need for taking long and regular strides forward in the planning process and periodically reporting on the major steps taken. To this end, the Commission conducts a major update and prepares a revised report on the approved regional plan every two years. Work on updating the 1977 report began in the fall of 1978. The update effort emphasized formulating planning objectives, better defining the basin's water resources problems and opportunities, and acquiring better information on ongoing and planned water resources programs throughout the basin. This report presents the results of the Commission's update effort, the approved regional plan for the Missouri River Basin.

PURPOSE OF THE PLAN

The purpose of the regional plan is to provide decisionmakers and planners at all levels of government a documented comprehensive, flexible, and balanced plan. It provides direction, guidance, and suggestions for further planning to member agencies and States for the conservation, utilization, development, and management of the basin's water and related land resources. The recommended programs and additional conclusions and recommendations in Chapters 2 through 10 are supported for implementation by all Commission members. Evolutionary in nature, the plan is intended to be consistent with changing regional and national economic, environmental, and social goals. More specifically, the plan is intended to serve the following purposes:

- o provide better access to Federal programming for State, local, and nongovernmental entities;
- o identify and display the relationships between Federal, State, regional, and major local water and related land resources activities;
- o assist in avoiding conflicts and duplication in planning by utilizing a centralized review and analysis of all prospective regional projects and programs;

- provide the potential for assessing regional economic and environmental effects of implementing the plan, effects not apparent through project-by-project evaluation;

- inform Federal agencies, the Federal administration, and the Congress of regional needs for program budgeting and funding;

- communicate to State legislatures and administrations the need for State and regional programs; and

- assist Congress and the Federal Government in setting regional priorities for budgeting and funding water resources programs in the Missouri River Basin.

CONTINUOUS PLANNING PROCESS

The Commission's preparation and maintenance of the regional plan follows a dynamic and continuous process, a process necessitated by continually changing legal and institutional structures, resource conditions, social values, and planning information. Changes in the regional plan are introduced on a regular and progressive basis. Information and recommendations from regional planning studies, along with legal and policy changes which affect natural resources planning, are continually recorded and summarized.

The principal sources of planning information and bases for change in the regional plan are: (1) water planning studies conducted by each of the Commission member States; (2) federally funded level B and special studies, especially the level B studies already completed by the Commission for the Platte River Basin in Nebraska the Yellowstone River Basin and adjacent coal areas in Montana, Wyoming, and North Dakota, the Upper Missouri River Basin Level B Study, and the James River Basin Subregional Analysis; (3) level C and other studies conducted by the Commission's Federal member agencies; (4) the Commission's continuing planning program; and (5) other relevant studies, including those of private entities.

The basin is divided into eight subbasins, each one of which is a distinct drainage area. The subbasins, which are shown on figure 1, are the Upper Missouri, Yellowstone, Western Dakotas, Eastern Dakotas, Platte-Niobrara, Middle Missouri, Kansas, and

Figure 1 - Missouri River Basin, Subbasins and Subregions

Lower Missouri. For planning purposes each subbasin is further divided into water resources subregions. The 29 subregions in the Missouri Basin, which are also shown on figure 1, are a part of a national hydrologic unit network utilized by all Federal water resource agencies.

The Commission's continuous planning process currently involves preparing and keeping up to date (1) reference material for recommended and potential plan elements; (2) a description of geographical characteristics and natural resources development; (3) a set of State planning objectives; and (4) definitive descriptions of water and related land resources problems and opportunities. The plan itself consists of (1) the planning objectives; (2) recommended water resources programs; and (3) conclusions and additional recommendations.

Upon completion of any major update of the regional plan, a revised plan is transmitted for official 90-day review to the head of each Federal department or agency, the Governor of each State, and each interstate agency from which a member of the Commission has been appointed. This official review is mandated by P. L. 89-80. Following the review and comment period, the approved plan and official comments are forwarded, as required by law, to the Governors and legislators of the participating States and to the U.S. Water Resources Council for transmission to the President and by him to the Congress.

Because the plan must be flexible and responsive to changing needs and conditions, the plan may be updated by the Commission at any regularly scheduled quarterly meeting. While such changes will not ordinarily affect the general thrust of the plan presented in this report, it is important to recognize that such changes are likely to occur.

The Commission's annual priorities program is an integral part of the regional planning process. Through the priorities program, the Commission annually develops a set of regional priorities for Federal water and related land resources programs and projects. All priorities are elements of the approved regional plan. The process for regional priorities is described in appendix E.

PREPARATION AND SCOPE OF PLAN UPDATE

The process followed by the Commission in updating the initial regional plan was aimed at making three improvements.

First, in order to better address regional goals and policies, a set of planning objectives was prepared by each member State. These planning objectives provide a means for evaluating the alternative water resource programs. The second advancement in the update was the compilation of the basin's major water resources problems and opportunities. Documentation of problems serves as an aid in assessing the relevance and need for programs. The third major improvement implemented during the update was the collection of more information about ongoing, planned, and potential programs. Collectively these improvements provided a firm basis for updating the plan and for making the approved regional plan more useful to aid in water resources programming, budgeting, and funding.

The update was conducted in the following steps, outlined below:

a. Each State formulated its planning objectives for fourteen water-related functions.

b. Commission staff compiled an initial list of water resources problems and opportunities for each of the eight subbasins.

c. Information was compiled about ongoing, planned, and potential water resources programs in the basin. The information included program purpose, location, facilities, conduct, funding requirements, functions addressed, status, and agency involvement.

d. Eight subbasin planning teams, with help from broader subbasin review groups, reviewed the State planning objectives, the initial list of problems and opportunities, and applied a set of Planning Committee approved criteria to the large initial listing of water-related programs. The criteria were used to select programs for the plan which: are water related; have broad impacts; funding exceeds $75,000 annually; are conducted after fiscal year 1980; and are not merely regulatory or administrative.

   A Basinwide Programs Subcommittee evaluated programs with basinwide application.

e. Each water resources program was further evaluated for its compatibility with other programs and planning

objectives, and with respect to identified problems and opportunities. The programs judged to be most effective in addressing problems and realizing opportunities are those recommended in this plan.

f. All of the recommended programs were evaluated with respect to their collective adequacy and effectiveness for addressing identified problems and opportunities. Where necessary, additional actions were recommended.

g. A draft update report was prepared, reviewed by the Commission, and approved by the Commission.

h. The report presenting the Commission's approved regional plan was transmitted to the heads of the Federal, State, and interstate members of the Commission and to the public for official 90-day review. After the review, all comments were considered by the Commission and adjustments in the report were made as needed.

i. The final report was transmitted to State and Federal agencies, basin State Governors, State legislatures, Congress, and the U.S. Water Resources Council.

THE REPORT

This report presents the current water resources management plan for the Missouri River Basin with a minimal amount of background and support material intended to facilitate understanding the plan, its purposes, objectives, and origin. The plan focuses only on water and related land resources planning objectives, problems and opportunities, and recommendations as required by law.

Just as the Commission's planning activities are conducted principally by water resources subbasin, this report is organized by subbasin. With certain qualifications, the plan for each subbasin is presented in a separate chapter. Since there are numerous basinwide and statewide plan elements which apply to all or most of the subbasins, these are presented in a separate chapter, chapter 2, which deals with the entire Missouri River Basin. The plan for each subbasin consists, therefore, of both the plan elements presented in the subbasin's respective chapter and the relevant plan elements from the basinwide chapter. The reason for presenting each subbasin's plan in two parts is that

there are many basinwide and statewide programs which relate to several or all of the subbasins. To include each of the programs with all of the subbasins to which they relate would have required repeating most of the elements throughout the report. This organization serves, therefore, to eliminate a large amount of duplication and significantly shortens the report.

Much of the material presented in this report is broken down into 14 water resources functions. These are categories which are intended to characterize the main thrust of specific planning objectives, problems or opportunities, and recommended programs. The functions or categories used are the following:

- Comprehensive Planning and Support Activities
- Flooding
- Fish and Wildlife
- Irrigation
- Land Conservation and Management
- Municipal, Industrial, and Rural Domestic Water Supply
- Natural, Historic, and Cultural Resources
- Power and Energy
- Water-Associated Outdoor Recreation
- Transportation
- Water Quality
- Legal and Institutional Factors
- Instream Flows
- Weather Modification

Chapter 2 of the report, "Missouri River Basin," describes the Missouri Basin's physical, biological, socioeconomic, water resources, and legal and institutional characteristics, an overview of the basinwide plan, recommended basinwide and statewide programs, and a set of conclusions and additional recommendations which apply to the entire Missouri Basin. The recommended programs in this and each subbasin chapter are presented in a tabular format. The listing for each recommended program shows the lead agency, major functions, status, type, schedule, location, main features, and cost.

The conclusions and additional recommendations provided in the basinwide chapter and each subbasin chapter generally address actions which need to be taken in addition to implementing the recommended programs. Where the needed action is not clear at this time or where no additional action is needed, only conclusions are drawn.

Each of the eight subbasin chapters, chapters 3 through 10, is divided into six sections: subbasin description; water resources problems and opportunities; planning objectives; plan overview; recommended programs; and conclusions and additional recommendations. The description of each subbasin is a summary, highlighting its unique and more pertinent characteristics. More complete information on subbasin characteristics is available in The Missouri River Basin Comprehensive Framework Study and Missouri River Basin Water Resources Plan.

Chapter 11, Environmental Impact Statement, prepared in accordance with the terms of the National Environmental Policy Act of 1969, describes the environmental impacts associated with implementing the plan.

Each section on water resources problems and opportunities is also a summary and serves only to focus attention on the more serious and urgent problems and the most important opportunities in the subbasin. A more complete statement of each subbasin's water resources problems and opportunities is given in appendix D.

The third section in each subbasin chapter summarizes the State planning objectives for the subbasin. This section highlights the State water resources policies, goals, and objectives of special significance to water resources planning in the subbasin. A more complete statement of State planning objectives is printed in appendix C.

A plan overview is provided for each subbasin in order to relate recommended programs and conclusions and additional recommendations to their need and to planning objectives.

As indicated above, the recommended programs for each subbasin are presented in tabular form, providing summary information concerning each program. The conclusions and additional recommendations are intended to supplement the recommended programs, bridging the gap between what the recommended programs can accomplish and the sum of identified water resources needs of the subbasin.

APPENDICES

Five appendices are bound into this report: appendix A, Index of Recommended Programs and Recommendations by Lead Agency;

appendix B, Index of Recommended Programs and Recommendations by State; appendix C, State Planning Objectives; appendix D, Water Resources Problems and Opportunities; appendix E, Regional Priorities; and appendix F, Official Comments on the Plan.

Appendix A gives the recommended programs and additional recommendations to be conducted by each agency, permitting the reader to locate each program and recommendations. Appendix B lists programs by State and lead agency, giving the reader a composite of recommended programs and recommendations for each of the 10 member States. A complete statement of current State planning objectives is given in appendix C and appendix D, presents a more complete listing of subbasin problems and opportunities. The Commission's adopted priority process is presented in appendix E. Appendix F presents the comments received through the official 90-day review of this report.

CHAPTER 2

MISSOURI RIVER BASIN

The Missouri Basin is vast and diverse. This chapter describes its diverse nature under five headings: physical characteristics, biological and esthetic characteristics, socioeconomic characteristics, water resources characteristics, and legal and institutional characteristics. The description provides a perspective for understanding the direction of and need for implementing the regional plan for the Missouri River Basin.

The basin description is followed by an overview of the basinwide and statewide components of the plan. The basinwide components, which are presented in tabular form following the plan overview, are recommended programs of significance to all or a large part of the Missouri River Basin. A series of recommended statewide water resources programs follows the basinwide programs section. The final section of this chapter presents conclusions and additional recommendations of basinwide application.

It is important to note that the plan for each subbasin includes both the material presented in the respective subbasin chapter and also the relevant basinwide and statewide recommendations in this chapter.

DESCRIPTION OF THE MISSOURI RIVER BASIN

PHYSICAL CHARACTERISTICS

The Missouri River Basin encompasses one-sixth of the

Figure 2 – Missouri River Basin, Physiographic Divisions

contiguous area of the United States. It is bounded by the Rocky Mountains on the west, by Canada on the north, by the Souris-Red River basins on the northeast, by the upper Mississippi River basin on the east, and by the Arkansas-White-Red River basins on the south. Figure 2 shows that the basin includes all of the State of Nebraska; most of Montana, South Dakota, and Wyoming; about half of Kansas, Missouri and North Dakota; smaller parts of Colorado, Iowa, and Minnesota; and parts of southern Alberta and Saskatchewan in Canada. The Missouri River is formed by the junction of the Jefferson, Gallatin, and Madison Rivers in southwestern Montana and flows generally southeastward 2,315 miles to its junction with the Mississippi River 15 miles above St. Louis, Missouri. The Missouri River and its tributaries drain 328.5 million acres within the United States and about 6.2 million acres within Canada. The Canadian drainage area is not considered in this report.

Three major physiographic divisions within the basin, as shown in figure 2, are the Interior Highlands, the Interior Plains, and the Rocky Mountain System. The western boundary of the basin is formed by the Rocky Mountain System, an area of exceptionally rugged topography. Many of its peaks surpass 14,000 feet (mean sea level) in elevation. This 35.2 million acre mountainous area is marked by many high valleys, but the peaks and mountain spurs are predominant.

Extending eastward from the Rocky Mountain System are the Interior Plains, including some 230.4 million acres classified as the Great Plains province and 56.3 million acres called the Central Lowlands province. The Great Plains province is in the west central part of the basin and has, in general, a flat to gently rolling topography. Average west to east slopes are about 10 feet to the mile from an average elevation of 5,500 feet along the western boundary of the Great Plains at the foot of the Rocky Mountains to the 1,500-foot contour that approximates the eastern boundary of the province.

There are two other types of landforms within the Great Plains. Isolated dome-type uplifts have formed rugged, almost mountainous areas such as the Black Hills of western South Dakota and northeastern Wyoming. The other type of landform consists of moderately sloping sand dunes stabilized by grasses with many shallow basins, ponds, and marshes. Principal among these is the Sand Hills area of north central Nebraska.

The other province within the Interior Plains, the Central Lowlands, extends eastward from the Great Plains to the upper Mississippi River divide. The land is generally level except where stream development has created a hilly topography.

In the southeastern part of the basin is a 7 million acre area of hilly to mountainous land called the Ozark Plateaus of the Interior Highlands.

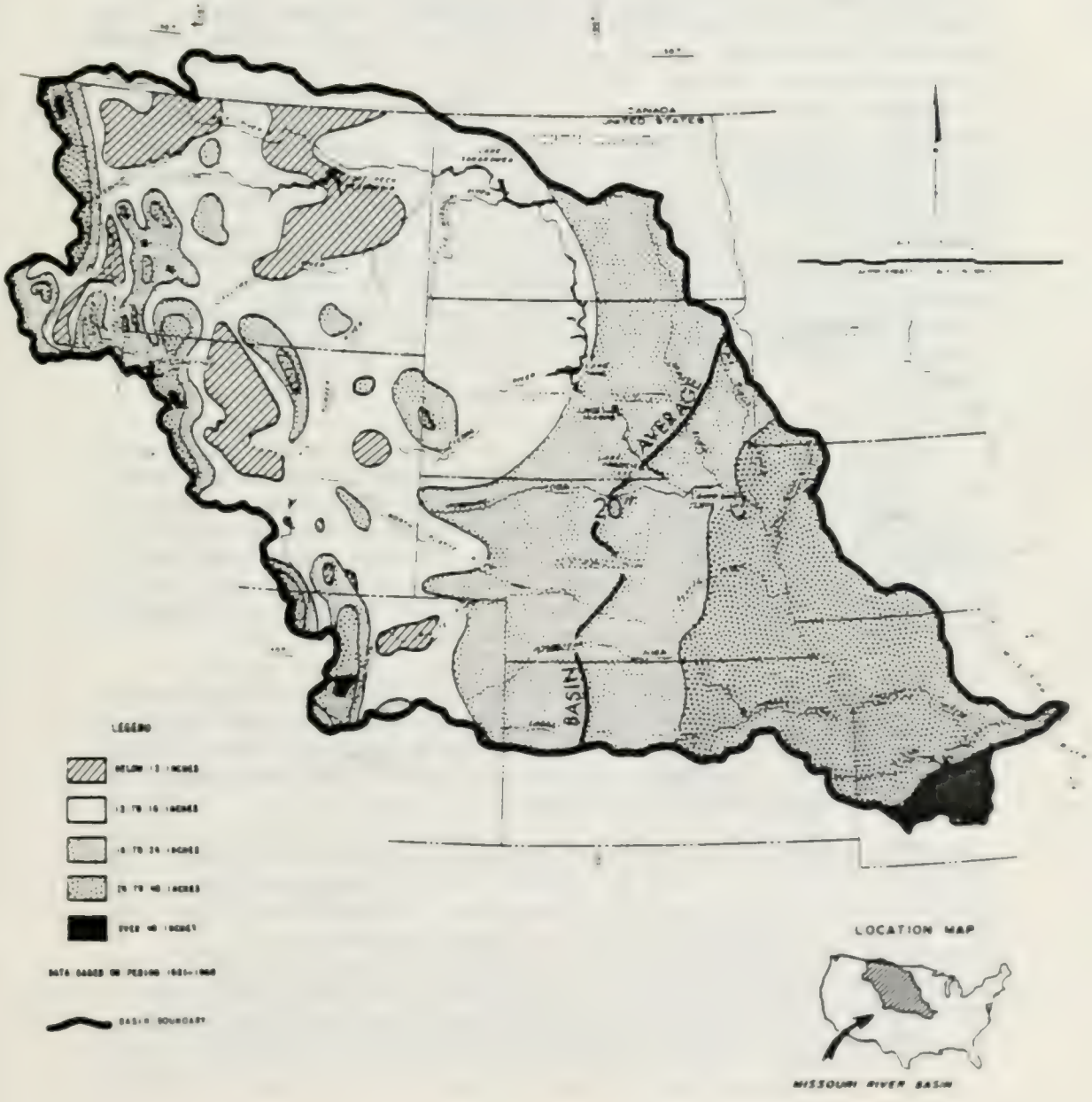
The climate within the basin is determined largely by the interaction of four extensive air masses: warm, moist air from the Gulf of Mexico; cool, moist air from the northern Pacific Ocean; cold, dry air from the northern polar regions; and hot, dry air from the plateaus in north central Mexico. Because of the extreme differences in the characteristics of these four air masses, weather changes are sudden and severe. Local climates vary greatly with elevation, slope, and exposure within the mountains, as evidenced by substantial temperature and precipitation anomalies. Lifting of air masses over the Rocky Mountains often produces precipitation on the windward side of the mountains and dry, warm chinook winds on the leeward side.

Primarily because of its mid-latitude and mid-continent location, the basin experiences weather that is known for its fluctuations and extremes. Averages are misleading because average weather seldom actually occurs. Instead, weather tends to fluctuate widely around the annual averages.

Normal annual precipitation varies from west to east in the basin, averaging over 35 inches in the Rocky Mountains of the western boundary, about 14 inches on the Great Plains, about 26 inches on the Central Lowlands, and over 36 inches in the Interior Highlands. Figure 3 shows normal annual precipitation for the period 1931-1960. About 70 percent of the precipitation occurs as rainfall during the growing season. The extent of snowfall and snowpack in the higher elevations of the basin are important sources of surface water in the basin.

One climatic factor of great importance because of the agricultural activity in the basin is the length of the freeze-free period. The freeze-free period is the average number of days each year between the last freezing temperature in the spring and the first freezing temperatures in the fall. While the freeze-free period does not completely define the growing season for all crops and grasses, it is a general indicator of the most favorable period. The length of the freeze-free period in the basin is about 30 days in the higher elevations of the

Figure 3 - Missouri River Basin Normal Annual Precipitation



Rocky Mountains, about 140 days on the Great Plains, and about 180 days in the Interior Highlands.

BIOLOGICAL AND ESTHETIC CHARACTERISTICS

Terrestrial Biological Resources

Ecosystems of the Missouri River Basin were originally dominated by grasslands in the prairies and plains region, and by forests, shrublands, mountain grasslands, and alpine tundra in the mountainous regions. Gallery forests have developed along the major rivers and streams, especially in the Middle Missouri and Lower Missouri subbasins. During the last few years many grasslands of the plains and prairie region have been converted to cropland where soils, topography, and climate favorable to farming exist. Although river bottomland forests in many parts of the basin have been eliminated or have deteriorated, many still afford key habitat for native plants and animals. Sizable acreages of natural grasslands also persist in several areas. The shrubland, woodland, and forest land of the mountains have not been subjected to the disturbances such as those which have occurred on the prairies and retain more of their natural characteristics.

Native plants and animals in the Missouri River Basin have been exposed to a succession of changing environments in the geological past, and only a few known endemic species have managed to survive the extremes of the ice age. Many species which survived the glaciers were forced to migrate or were subsequently exposed to disturbances caused by man. As a result, some became extinct, others lost most of their habitat.

Big game animals such as moose, elk, deer, Rocky Mountain goats, big horn sheep, and grizzly and black bears, continue to inhabit the basin. Also, a nearly extinct species, the native bison, has made a comeback through development and management of herds on private and public lands.

Small game are in abundant supply in most basin States, although the white-tailed jackrabbit is now nearly extinct in Missouri, Kansas, and parts of Nebraska. Upland game birds tend to be scarce, with the exception of mountain grouse in mountainous western regions and sharptail and sage grouse in portions of Montana, Wyoming, South Dakota, and Nebraska. The northern greater prairie chicken is persisting in sizable numbers in a few prairie regions, particularly in Kansas, but is

considered a threatened species in several other States. Ring-necked pheasants, a valuable hunting resource, have suffered severe population declines in several States. Quail surpluses are beginning to disappear as habitat declines over Nebraska, Iowa, Kansas, and portions of Missouri. Of the upland game birds, only wild turkey populations have increased during the past decade. Further enhancement is limited, however, because of lack of suitable woodland habitat.

Aquatic Biological Resources

The natural lakes and streams of the basin contain mostly plant and animal life common to other major river basins in North America. In the Missouri River, an original array of native fish species lives in free flowing reaches. However, several species, the sturgeons, the paddlefish, and several forage types, have become rare, threatened, or endangered. Others such as the sauger and blue catfish have also greatly declined in number. Consequently, the quality of sport fishing is generally only fair.

Tributaries of the upper Missouri, Yellowstone, and Platte Rivers and the alpine lakes in Colorado, Wyoming, and Montana have cold waters which support high quality trout fisheries. Management of the larger reservoirs has at times produced high quality fisheries of trout, bass, northern pike, and walleye. High quality warm water natural streams, especially the Gasconade and Niangua Rivers in Missouri, contain a highly diverse population of fish.

Although drainage has eliminated many of the wetlands in the lower States of the basin, extensive areas still exist in Montana, North Dakota, South Dakota, and in the Nebraska Sand Hills. Duck populations have varied, but the goose population has been more stable during the past decades and has increased slightly. In some semiarid portions of the basin, development of small reservoirs and stockponds has enhanced waterfowl populations. This development has only partially offset the loss of natural wetlands.

Historically, other aquatic or aquatic-dependent species have not fared as well as waterfowl. Large furbearers such as the river otter, now nearly extinct in the basin, and various large birds such as the endangered whooping crane, and to a lesser degree, the northern bald eagle, the white pelican, the trumpeter swan, and the osprey, fall in this category.

Natural, Esthetic, and Cultural Resources

Many unique or outstanding large natural areas in the basin have been preserved or are managed by the Federal Government. These areas include scenic badlands, high mountain ranges, mountain streams and canyons, alpine lakes, extensive coniferous forests, lakes and marshes in the sandhill prairies, and several unique landmarks and geological formations. Several outstanding wilderness areas within the national forest system have been preserved, and recently a number of grassland wilderness areas were set aside as national refuge or monument lands. Several national parks, including Glacier, Yellowstone, and Rocky Mountain, provide extensive outdoor recreation.

Since the passage of the national Wild and Scenic Rivers Act, increased attention has been given to qualifying rivers within the basin as wild and scenic or recreational. Federal efforts have been supplemented by State and private efforts to acquire outstanding natural areas. In some cases the private effort has been significant in filling in voids in Federal and State programs. Cultural, historic, and archaeological resources have also received Federal protection and interpretation, and several outstanding sites have been acquired.

SOCIOECONOMIC CHARACTERISTICS

Population

In 1975, the population of the basin was estimated at 9 million, or about 4.3 percent of the national total. Although the basin's population has slowly increased since 1940, its proportion of the U.S. population has declined, reflecting a decline in small-scale farming and agricultural employment.

Fifteen Standard Metropolitan Statistical Areas (SMSA's) are currently designated in the region. Their locations are shown on figure 4. They contained nearly half of the basin's total population and 75 percent of its urban inhabitants in 1975. All metropolitan areas in the basin have experienced population increases since the 1930's.

Two trends can be expected to influence future settlement in the basin. First, population is expected to increase in those urban areas near energy development sites. A second is the increased preference of persons not engaged in agriculture to settle outside of metropolitan areas.

Figure 4 - Missouri River Basin - Standard Metropolitan Statistical Areas

The native American Indian is an important ethnic group in the basin. In 1975, the estimated Indian population of the basin's 23 reservations totaled 65,400. Indian population on reservations is projected to grow to nearly 84,000, an increase of over 25 percent, by the year 2000. The 1970 U.S. Census showed the median income for Indian families to be about half that for non-Indian families and far below the federally defined poverty level.

As shown in table 1, basin population is projected to increase by 11 percent over the period 1975-1985, and by 30 percent over the period 1975-2000. Changes in the spatial distribution of the population will accompany increases in total population. Most notable is an expected 48 percent growth in urban population by the year 2000. Correspondingly, rural population is projected to decrease by 4 percent during the 1975-2000 period.

Employment

The Missouri River Basin is one of the Nation's most economically diverse areas. While agriculture has historically dominated the economy, the region also has produced metallic and precious minerals, timber products, energy fuels, and electric power. More recently, substantial increases in mining, manufacturing, and recreation-tourism have served to further diversify the economic activities.

Historical and projected employment characteristics of the basin generally correlate with those of the Nation. From 1940 to 1960, the region experienced a 35 percent decline in agricultural employment while realizing a 116 percent increase in the manufacturing sector and a 60 percent increase in the other employment sectors. Projected employment trends for the period 1975-2000 show a continuation of the historical employment distribution pattern, but at a slower rate of change. By 1985, manufacturing employment is projected to stabilize at 14 percent of the basin's employed population. Agricultural employment will continue to decline through 2000 and should achieve stability at about 6 percent of the basin's employed population around the turn of the century.

Between 1975 and 2000, Indian employment is projected to increase from 17 percent of the Indian population to 19 percent.

TABLE 1
POPULATION AND EMPLOYMENT CHARACTERISTICS FOR
1975, 1985, AND 2000
MISSOURI RIVER BASIN

Population/ Employment	1975	1985	2000	Percent Change 1975-2000
Population	9,068,000	10,063,500	11,805,300	+30
Urban	5,942,900	6,974,300	8,810,300	+48
Rural	3,125,100	3,089,200	2,995,000	- 4
Employment	3,912,000	4,981,200	5,596,800	+43
Agricultural	414,200	388,100	338,500	-18
Nonagricultural	3,497,800	4,593,100	5,258,300	+50

Source: 1975 National Water Assessment, Missouri Region
State-Regional Future

In 1970, Indian unemployment was about seven times that for the United States overall, as high as 70 percent on some reservations.

Economy

Since the Federal Homestead Act of 1862 opened the land in the Missouri River Basin to agriculture, the basin has become an extremely important producer of the Nation's and the world's food supply. By the early 1970's, farmers and ranchers within the basin annually produced close to 33 percent of the U.S. wheat crop, 25 percent of the Nation's sorghum, 25 percent of the Nation's hay, and 22 percent of corn grown for grain. In addition, the region was producing in excess of 20 percent of the Nation's livestock and poultry. From a broader agricultural perspective, regional production accounts for 10 to 12 percent of the world corn harvest and 4 to 6 percent of the world wheat crop annually. Despite the decline in the number of workers engaged in agriculture, this sector is expected to continue as the dominant economic activity.

The basin possesses significant hardwood and softwood timber resources, primarily concentrated in the Rocky Mountains, the Black Hills, and the Ozark Plateau. Harvesting trends have shown increasing timber production since 1961. A large percentage of forests and woodlands are also grazed, providing a second valuable agricultural use.

Metallic and nonmetallic minerals and energy fuel resources developments are important factors in the basin's economic growth. Deposits of metallic ores in the Rocky Mountains and the Black Hills contribute to the Nation's production of gold, silver, copper, lead, zinc, taconite, uranium, and molybdenum. In addition to metallic minerals extraction, large quantities of nonmetallics such as fluorspar, feldspar, phosphate, lime, mica, bentonite, and construction aggregate are mined in the basin.

Energy fuels presently constitute the largest and most valuable share of all nonrenewable resources produced in the basin. The 10 basin States collectively have more than 450 billion tons of recoverable coal reserves, or about 55 percent of the Nation's total. The national importance of the reserves is evidenced by recent dramatic increases in coal and lignite production. In the seven years from 1965 to 1971, coal production as a percentage of the national tonnage grew only slightly from 3 to 4 percent. For the period 1971 to 1973,

however, the basin contribution to total national production increased from 4 percent to almost 8 percent. Except for Nebraska and the Minnesota portion of the basin, all basin States contain substantial coal reserves that are expected to be of increasing national importance in the future.

The Missouri Basin is also an important source of crude petroleum, natural gas, and uranium. Although total petroleum output had declined from 1971 levels, production in 1973 still accounted for 6.5 to 7 percent of the U.S. total. While the future outlook for crude oil, oil shale, natural gas, and uranium production is uncertain, new exploration and recovery efforts are taking place.

Manufacturing activities in the Missouri Basin are varied, but to a large degree reflect the economic predominance of agriculture. Food processing and production of agricultural machinery contribute substantially to manufacturing earnings and employment. Industrial composition projections indicate, however, that a decline in the relative economic importance of these types of activities is likely to occur. Other important types of manufacturing include electronics, automobile assembly, light industrial activity, paper and lumber production, and chemical and petroleum production. At present, most industrial activities are located in the southern subbasins.

Opportunities to participate in diverse forms of outdoor recreation activities are numerous throughout the basin. In certain subbasins, including the Upper Missouri, Yellowstone, and in the western portion of the Platte-Niobrara subbasin, recreation and tourism are basic to the overall economy, with recreational activities serving as the primary industry for some local areas.

Land Use

The entire Missouri River Basin became the property of the U.S. Government as part of the Louisiana Purchase in 1803. Although substantial land holdings are retained today as Federal public domain, more than 86 percent of the basin's land is in private, Indian, State, and local governmental ownership. Large Federal tracts are managed by the Forest Service (19.4 million acres), Bureau of Land Management (18.5 million acres), National Park Service (2.3 million acres), Corps of Engineers (2.2 million acres), the Water and Power Resources Service (1.0 million acres); and lesser acreages (1.4 million acres) managed by the

military, Fish and Wildlife Service, Bureau of Indian Affairs, and Agricultural Research Service. About 12 million acres, or 4 percent, of the nearly 284 million acres of privately held lands are Indian lands. Title to this land is held in trust by the U.S. Government, but it is legally considered private land owned either by individuals of native American or Indian descent or by tribes.

Based upon estimates made for the U.S. Water Resources Council's 1975 National Water Assessment, approximately 298 million acres or 92 percent of all land in the Missouri Basin is used for agricultural purposes. More than half of the agricultural land is used for pasture and rangeland. Forest and woodlands occupy another 26.3 million acres. Forest and woodland and pasture and range acreages are expected to decline during the next quarter century, contributing to a moderate overall decline in total agricultural lands.

Dryland farming is the second largest type of agricultural land use in the basin, exceeded only by pasture and rangelands. These nonirrigated croplands are projected to increase over the next 25 years by some 2 percent from their current level of nearly 90 million acres.

Irrigated cropland, estimated at 11.4 million acres in 1975, constitutes about 4 percent of the present agricultural total. Irrigation is projected to be applied to an additional 2.8 million acres by 1985 and to 5.9 million acres by 2000, covering more than 17 million acres by the year 2000.

The basin's urban and transportation lands are expected to expand from the present 7.4 million acres by 10 percent by 1985, and by 23 percent by the year 2000. Estimates of Missouri Basin land and water acreage for 1975, 1985, and 2000 are summarized in table 2.

WATER RESOURCES CHARACTERISTICS

The Missouri River Basin is, in general, well endowed with surface and ground water resources. However, the occurrence and availability of water is highly variable, subjecting portions of the basin to recurrent local and seasonal shortages.

Surface Water Availability

Precipitation annually provides more than 500 million acre-

TABLE 2
LAND AND WATER ACREAGE FOR
1975, 1985 AND 2000
MISSOURI RIVER BASIN

Land Use	1975	1985	2000
		1,000 acres	
Agricultural Lands			
Cropland			
Nonirrigated	89,659	91,133	91,024
Irrigated	11,303	14,139	17,154
Pasture and Range	167,450	162,298	158,465
Forest and Woodland	26,296	26,156	26,072
Other	3,698	3,689	3,697
Subtotal	298,406	297,415	296,412
Nonagricultural Lands			
Transportation, Urban Built-up	7,435	8,149	9,099
Other	18,069	18,114	17,954
Subtotal	25,504	26,263	27,053
Total Land Area	323,910	323,678	323,465
Total Water Area	4,598	4,830	5,043
Total Area	328,508	328,508	328,508

Source: 1975 National Water Assessment. Missouri Region State-Regional Future

feet of water. Infiltration and evaporation deplete a large amount of this naturally occurring moisture. Runoff entering the streams varies widely across the basin, ranging annually from less than an inch in parts of the plains to more than 12 inches in the mountains and the humid southeast. This runoff would account for an average of about 65 million acre-feet of natural flow annually at the mouth of the Missouri River near St. Louis, Missouri, exclusive of evaporation and consumptive uses attributable to water resource project developments.

Under 1970 conditions of development and utilization, the net average annual outflow from the basin was estimated to be 53.6 million acre-feet.[1] Recent appraisals, based upon an aggregation of basin State's estimates of water use, indicate a 1975 average annual flow of 49.4 million acre-feet at the mouth of the Missouri River near St. Louis.

Abnormally high and low streamflows are not uncommon in most parts of the basin. Indicative of the drought potential is the fact that natural runoff as low as half the mean has occurred in nearly 10 percent of the years of record. At the other extreme, severe flooding caused by snowmelt, spring rains, and thunderstorms, is common in many drainages throughout the basin.

Surface Water Quality

Overall, the water quality of the basin's waterways can be classed as fair. In the western portions, many of the mountain streams remain pristine and pollution-free in their headwaters. Sediment and dissolved solids concentrations become major problems in the rivers as they flow across the plains. In areas where irrigation is practiced, return flows from croplands are often laden with fertilizers, pesticides, and herbicides, degrading nearby watercourses. Runoff containing high concentrations of organic wastes from animal feedlots is another major agriculture-related water quality problem. Finally, municipal and industrial wastes continue to pollute many of the basin's major and minor streams, although ongoing plans and programs are striving to alleviate many of the problems.

Ground Water Availability

Ground water is the principal water supply source in many areas of the Missouri River Basin. Fortunately, the basin has been endowed with abundant ground water of quality suitable for most purposes. Shallow alluvial deposits are found along most

major watercourses. Also, extensive quantities of relatively shallow ground water underlie large portions of Nebraska, western Kansas, eastern Wyoming and Colorado, and parts of Missouri and South Dakota. In all, reserves lying at less than 1,000 feet deep are estimated at greater than 3 billion acre-feet.[2] Further, large amounts of ground water are known to exist in extensive sandstones and limestones at depths greater than 1,000 feet. Although these deeper deposits contain more water than the more accessible shallow aquifers, its use is limited by excessive pumping costs and variable quality.

Water tables in some areas of the basin are declining due to withdrawals in excess of recharge. Areas experiencing significant adverse effects include northwestern Kansas, eastern Colorado and Wyoming, northwestern Nebraska, portions of the Platte and Blue Basins in Nebraska, and parts of eastern Missouri. On the other hand, the ground water level is rising in portions of south central Nebraska due to irrigation canal seepage and infiltration from irrigated lands.

Ground Water Quality

The quality of ground water in the basin is variable. Water of highest quality is generally derived from dune sand, such as that found in north central Nebraska, and from deep igneous and metamorphic rock formations. Major sources of ground water are generally sedimentary deposits and valley alluviums. In the former, abundant shallow sandstone and limestone deposits generally yield water of adequate quality for most uses. Water recovered from valley alluviums is influenced by the quality of the surface water, the rock types in the valley, and the surrounding vegetation. Alluviums along many streams contain water with high sulfate concentrations.

Ground water containing concentrations of total dissolved solids exceeding 2,000 miligrams/liter, considered very poor quality, is found in highly developed aquifers in eastern Montana, central South Dakota, western Iowa, and northwestern Missouri.

Interrelationship of Surface and Ground Water

With increasing development of both surface and ground-water resources, their hydrologic interrelationship is becoming increasingly more important to users. Several types of effects have resulted from public and private water and land resource

developments. One of the most significant effects occurring in certain areas of the Missouri Basin has been the reduction of inflow to the surface system caused by withdrawals of associated ground water. Ground water pumping for sprinkler irrigation is diminishing streamflows otherwise available for instream and offstream uses in parts of Colorado, Kansas, and Nebraska. Other notable effects of development occurring within the basin include alteration of runoff and infiltration caused by changes in land use and management, such as conversion of grassland to cropland, and increased aquifer recharge due to surface water storage.

Existing Major Water Resources Development

Initial water resources developments in the Missouri River Basin, beginning more than 100 years ago, were earthen structures built on smaller streams to meet single purpose needs, primarily water supply. Since the 1930's, surface water developments have often been supplemented with ground-water development, particularly for privately developed irrigation on the plains of Colorado, Kansas, and Nebraska.

In the past 40 years, a number of major reservoirs have been constructed in the basin. Most of these projects were built to serve multiple purposes and differed markedly from the earlier single purpose developments. Project purposes include irrigation water supply, flood control, hydroelectric power generation, navigation, recreation, fish and wildlife enhancement, and industrial water supply.

Perhaps the most prominent multipurpose projects in the basin are the six major Missouri River main stem reservoirs--Fort Peck, Sakakawea, Oahe, Sharpe, Francis Case, and Lewis and Clark. With the exception of Fort Peck Reservoir, these large projects were constructed by the Army Corps of Engineers under the Pick-Sloan Missouri Basin Program, originally adopted by the Congress in 1944. The Corps was authorized to construct Fort Peck Reservoir in 1933. Each of these projects serves most or all of the purposes listed above. In addition, other large multipurpose projects have been or are being built by the Corps of Engineers and the Water and Power Resources Service in every subbasin in the Missouri Basin. Among these are Canyon Ferry in the Upper Missouri Subbasin; Boysen and Yellowtail in the Yellowstone; Shadehill and Keyhole in the Western Dakotas; Jamestown in the Eastern Dakotas; Seminoe and Glendo in the Platte-Niobrara; Smithville in the Middle Missouri; Tuttle Creek and Milford in the Kansas; and Stockton and Harry S. Truman in the Lower Missouri.

To meet land conservation and management needs, thousands of smaller reservoirs and farm ponds have been installed by the Soil Conservation Service, States, local soil conservation districts, and private individuals. These impoundments provide rural domestic, stock, and irrigation water supply, control sediment and rural flooding, and often provide municipal supply and control urban flooding. Other measures aid in the control of erosion and alleviate drainage problems.

A recent major development in the plains areas of the basin is the advent of center pivot irrigation. Center pivot units use ground water almost exclusively and usually irrigate a quarter section of cropland each. They have grown quickly in popularity during the last decade because of their ease of installation and operation. The aggregate investment in center pivot systems within the basin now ranges into the billions of dollars.

Hydroelectric power generation facilities are a major component of water development activity in the Missouri Basin. Their installed capacity currently exceeds 3,300 megawatts, representing over 15 percent of the basin's total. The significance of this capacity is perhaps greater than its percentage of the total, since it provides a very efficient, pollution-free source of peaking power for vast areas within as well as outside the basin. The largest hydroelectric power installations are at the main stem dams.

Another major development in the basin is navigation on the main stem of the Missouri River from Sioux City, Iowa, to the mouth near St. Louis, Missouri. Supported by regulated releases from the main stem reservoirs and tributary inflows, a channel 9 feet deep and 300 feet wide is maintained over a distance of 732 river miles. The normal navigation season is April 1 through December 1 of each year.

Water Use

Estimates of present and projected water use given in this report reflect, with minor modification, the results of the study conducted by the Commission for the 1975 National Assessment in cooperation with the U.S. Water Resources Council. The estimates for present and projected water supply and utilization were based primarily on basin State estimates of withdrawals and consumption, flow data contained in the 1971 The Missouri River

Basin Comprehensive Framework Study, and supplemental information provided by Federal agencies.

Water withdrawals from both ground and surface sources in 1975 were estimated at 38.3 million acre-feet. Withdrawals are projected to increase by 26 percent, to 48.4 million acre-feet by 1985; and by 40 percent, to 53.8 million by the year 2000. Water for irrigation accounts for about 80 percent of all withdrawals in each time frame. Withdrawals for cooling at steam-electric power plants, predominantly from surface sources, run a distant second, accounting for about 10 percent of withdrawals. All other purposes constitute the remaining 10 percent of water withdrawn.

Consumptive use of water is the estimated amount of water loss to the area. Thus, estimated totals shown for consumptive use reflect water taken from all sources including surface, related ground water, and mined ground water, and are not necessarily equal to streamflow depletions.

Consumptive use of water for all purposes was estimated to be 17.6 million acre-feet in 1975. Overall consumption of water is expected to increase to 22.5 million acre-feet by 1985, and to exceed 28.5 million acre-feet by the year 2000. Irrigation dwarfs all other consumptive uses, accounting for some 90 percent of the total in each time frame. Water consumption for livestock production and municipal and industrial purposes each comprise another 3 percent of total consumptive use.

Table 3 summarizes Missouri Basin gross withdrawals and consumptive use for seven major purposes for 1975, 1985, and 2000. Table 4 displays subbasin totals of gross withdrawals and consumptive use for all functions for the same three time periods.

LEGAL AND INSTITUTIONAL CHARACTERISTICS

Development and management of water resources has long been recognized in the Missouri River Basin as a joint responsibility of private interests, the States, and the Federal Government. Their resource objectives and programs are largely complementary, as are many of their water laws and policies, though areas of uncertainty and challenge do exist.

TABLE 3
WATER WITHDRAWALS (WD) AND CONSUMPTIVE USE (CU) FOR
1975, 1985, AND 2000 BY FUNCTION
MISSOURI RIVER BASIN

se	1975		1985		2000	
	WD	CU	WD	CU	WD	CU
	1,000 acre-feet					
ipal & ustrial	1,223	479	1,668	651	2,107	809
Domestic acturing	188	122	204	127	202	122
lf-Supplied)	728	217	1,020	376	1,308	567
g	350	127	362	131	446	154
ation	31,390	16,053	37,688	20,351	43,226	25,331
tock	489	480	653	643	826	814
Electric	3,960	75	6,804	264	5,690	713
uri Basin al	38,328	17,553	48,399	22,543	53,805	28,510

e: 1975 National Water Assessment, Missouri Region
State-Regional Future

TABLE 4
WATER WITHDRAWALS (WD) AND CONSUMPTIVE USE (CU) FOR
1975, 1985, AND 2000 BY SUBBASIN
MISSOURI RIVER BASIN

sin	1975		1985		2000	
	WD	CU	WD	CU	WD	CU
	1,000 acre-feet					
Missouri	7,043	3,527	7,923	4,086	8,804	4,645
wstone	7,445	3,181	8,267	3,654	9,155	4,150
rn Dakotas	1,576	703	3,198	1,185	4,673	1,990
rn Dakotas	518	304	782	474	1,175	786
e-Niobrara	12,434	4,923	15,554	6,261	16,670	8,550
e Missouri	2,258	232	3,244	325	2,342	432
s	5,556	4,506	7,622	6,261	9,171	7,496
Missouri uri Basin	1,498	177	1,809	297	1,815	461
als	38,328	17,553	48,399	22,543	53,805	28,510

e: 1975 National Water Assessment, Missouri Region
State-Regional Future

State Water Laws

In the general field of water law, basin States have adopted two fundamental doctrines which reflect both the origin of those who formulated the doctrines and also the variation in climatic and hydrologic conditions found from subhumid east to arid west.

The common law doctrine of riparian rights is based primarily on the ownership of land and the beneficial uses of water thereon from a contiguous source. Under the riparian rights doctrine the owner of land contiguous to a natural stream or natural lake may use the waters for such beneficial purposes and in such quantities as he chooses, so long as he does not appreciably diminish the flow or impair the quality of water for downstream uses.

Under the appropriation rights doctrine, the first beneficial appropriation in time is prior in right. Unlike the riparian doctrine, appropriations are established through a legal process for a definite rate of direct flow diversion or storage. Often the total quantity is specified as not to exceed a given acre-foot total per acre per season, or simply in total acre-feet, as in storage.

Of the Missouri Basin States, Minnesota and Missouri recognize primarily the riparian doctrine while Colorado, Montana, North Dakota and Wyoming have specifically repudiated it and have established the doctrine of appropriation rights. The Iowa water rights law makes diversion, storage, or withdrawal of water in the State subject to permit and administrative regulation and limits permits to a time period not to exceed 10 years. Kansas, Nebraska, and South Dakota depend mainly on the appropriation rights doctrine, but also use the riparian doctrine in varying degrees.

With respect to ground water, there are three common law rules which are applied throughout the basin. First, there is the so called "English rule" which gives the overlying landowner the absolute ownership of water percolating beneath the surface of his lands. Second, is the "American rule", which gives the overlying landowner the right to a "reasonable use" of such water. Third, is the "California rule", which gives the overlying landowner a correlative right to the use of the ground water underlying his land, but which requires him in times of shortage to share the resource with neighbors whose lands also overlie the water resource.

The States of Iowa, Minnesota, and Missouri apply the rules of reasonable use to ground water; Iowa and Minnesota require permits. The States of Colorado, Montana, North Dakota, South Dakota, and Wyoming treat ground water use similarly to surface water appropriation. Other basin States apply minimal control over landowner use of ground water, but usually require well permits. Further, the States of Colorado, Kansas, Montana, Nebraska, and Wyoming provide for designation of controlled ground water areas subject to more stringent management.

Interstate Compacts, Court Decrees, and International Treaty

Problems often develop in allocating interstate waters and administering water rights when rivers cross State boundaries and as water use increases. To deal with these problems in some Missouri River Basin river systems, several States have entered into interstate compacts or requested court apportionment of the affected waters. The U.S. Constitution provides that no State may enter into any agreement or compact with another State or with another Nation without the consent of Congress.

Figure 5 shows areas affected by the interstate compacts, interstate court decrees, and an international treaty. Interstate compacts control waters in seven basin States and four subbasins. Compacts on the Colorado River permit transbasin diversion from the Colorado into the Missouri drainage. Two U.S. Supreme Court decisions have adjudicated basin streams in three States, and an international treaty exists between the U.S. and Canada. Table 5 summarizes information on the treaty compacts and decrees affecting waters of the Missouri River Basin.

Federal Water Law, Programs, and Responsibilities

Federal water law is derived from two major sources, the Constitution and Federal statutes. Constitutional provisions account for those powers of the Federal Government which are expressly delegated or reasonably implied by the U.S. Constitution. Water related provisions include powers granted under the Commerce Clause, the Property Clause, the General Welfare Clause, the Treaty Clause, the Congressional Water Power, and Supreme Court Powers of water rights adjudication between States.

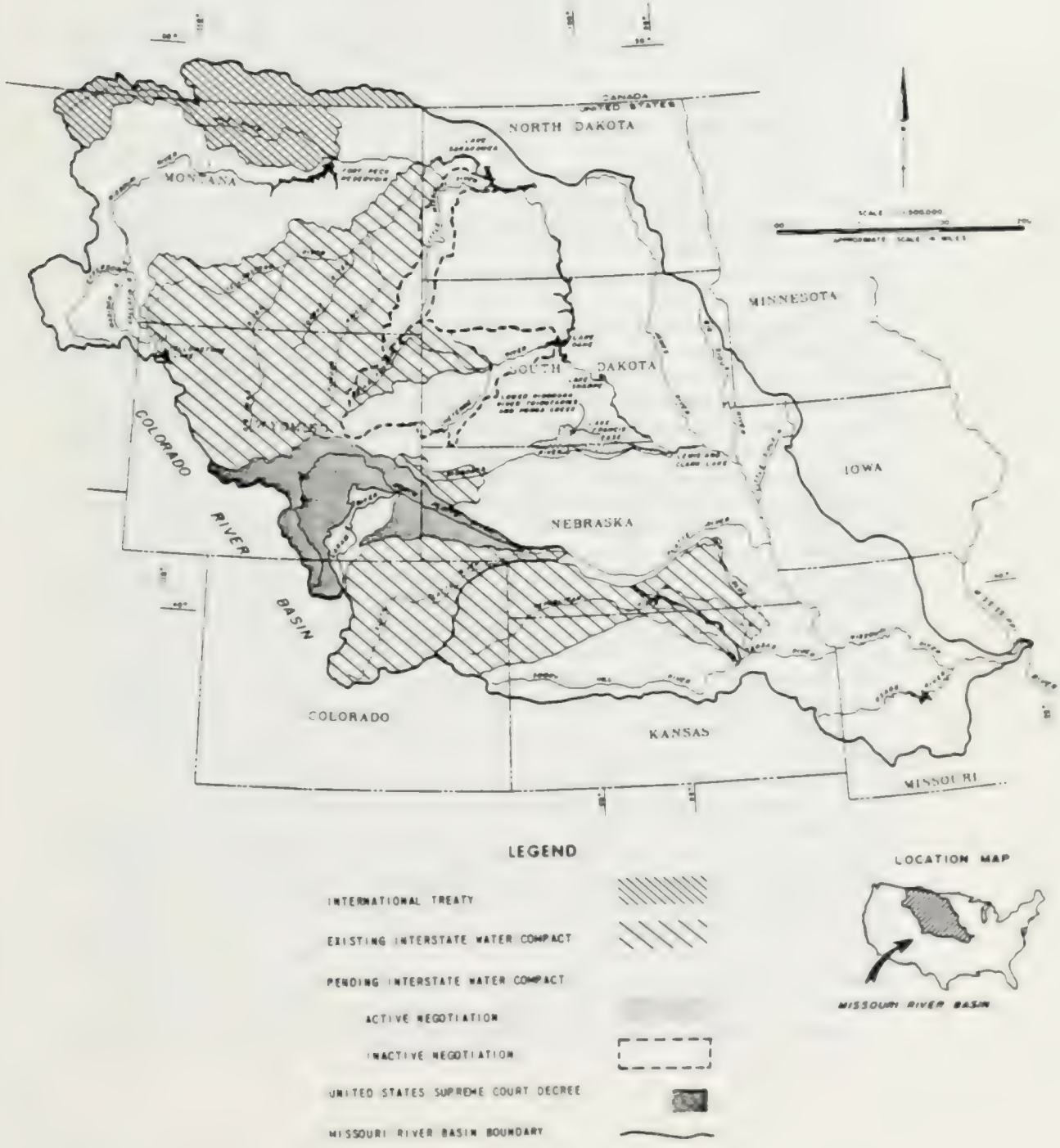
Federal statutory provisions include several major water laws, a great number of lesser acts, and specific project authorizations. It is within the complementary pattern and application of these laws and those of the States that federally

TABLE 5
SUMMARY OF WATER TREATY, COMPACTS AND COURT DECREES
MISSOURI RIVER BASIN

Item	Affected States	Affected Subbasins	General Principles
Treaties			
International Treaty	U.S. (Montana) and Great Britain (Canada)	Upper Missouri	Apportions waters of St. Mary and Milk Rivers equally between U.S. and Canada; major developments subject to International Joint Commission.
Interstate Compacts			
Belle Fourche River Compact	South Dakota, Wyoming	Western Dakotas	Established apportionment of direct diversion and storage; limits construction and operation of dams and reservoirs.
Big Blue River Compact	Nebraska, Kansas	Kansas River	Apportionment of interstate flows of the Big Blue and Little Blue Rivers and affected ground waters.
Republican River Compact	Colorado, Kansas, Nebraska	Kansas River	Allocates a given quantity, in acre-feet, for consumptive use to each State based on average virgin supply.
South Platte River Compact	Colorado, Nebraska	Platte-Niobrara	Provides for administration of water appropriations for the two states in a section of the South Platte River.
Yellowstone River Compact	Montana, North Dakota, Wyoming	Yellowstone	Allocates unused and unappropriated waters of four tributaries for storage and direct diversions; affects future construction and regulation.
Upper Niobrara River Compact	Nebraska, Wyoming	Platte-Niobrara	Allocation of unused and unappropriated waters for storage and direct diversions; also affects ground water for potential apportionment thereof.
Upper Colorado River Compact	Arizona, Colorado, New Mexico, Utah, Wyoming	Platte-Niobrara	Equitable division and apportionment of the use of water of Upper Colorado River between the five upper basin States. Transbasin diversions presently made to the Missouri River Basin.
Colorado River Compact	Colorado, Wyoming, Arizona, California, Nevada, Utah, New Mexico	Platte-Niobrara	Apportions the waters of the Colorado River between the upper and lower basin States; transbasin diversions presently made from the Colorado River Basin to the Missouri River Basin.
Interstate Decrees			
Laramie River	Wyoming vs. Colorado, 1922 (amended 1932, 1936, 1940, 1957)	Platte-Niobrara	Limits aggregate diversions in Colorado and those for transbasin diversions; also post-July 31 diversions, and Wyoming is entitled to remaining flow.
North Platte River	Nebraska vs. Wyoming and Colorado, 1945 (amended 1953)	Platte-Niobrara	Limits irrigated acreage, total annual storage and out-of-Basin diversions in Colorado; irrigated acreage, total annual storage and apportionment of natural flow with Nebraska in Wyoming. Provisions are made also for use of Federal storage located in Wyoming on Wyoming and Nebraska land under contracts.

Source: MBIAC Framework Study Report

Figure 5 - Missouri River Basin, International Waterways Treaty
Interstate Water Compacts and Supreme Court Decrees



assisted water and related land resource development has proceeded.

Many Federal agencies administer programs designed to accomplish comprehensive water and related land use planning. Also, water related research and data collection are carried out by many of these and other agencies. Federal agencies carry out programs relating to navigation on the Missouri River, including regulatory measures, maintenance of channels, structural improvements, and reservoir river management to maintain streamflow. Federal activities with respect to the Nation's flood problems include structural measures to contain flood flows, land treatment measures to retard runoff, mechanisms such as insurance and disaster assistance to redistribute losses, and programs to promote regulations of land uses in flood prone areas to reduce the amount of flood damages.

Federal water supply programs are undertaken to capture and deliver water for agricultural, industrial, and domestic uses, to conserve available supplies and to increase usable supplies through measures such as land treatment and weather modification. Hydroelectric power programs include both Federal development and regulation of private development. Water quality is the object of regulatory programs and programs that include both structural and land treatment measures to control and prevent water pollution. Management and development of the Nation's fish and wildlife resources are the responsibility of a number of Federal agencies and, in connection with Federal water and water related programs, the value of these resources is recognized and measures are included for their conservation and development.

Promoting outdoor recreation is still another function of some Federal water programs. Recreation facilities are usually provided at Federal water projects. Federal agencies also regulate certain aspects of water based recreation activities. Other programs are directed at preserving the natural or undeveloped state of designated rivers, adjacent areas, and park or wilderness areas. Many national forests have been established in the basin. Like the other Federal public lands found extensively in the western half of the basin, they are administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes.

PLAN OVERVIEW

The regional plan is a series of recommended water resources

projects, programs, studies, and data collection activities which address the basin's major water resources problems and opportunities, within the structure of State planning objectives. Each of the 10 basin States has prepared planning objectives for water and related land resources management. These objectives, which are presented in appendix C, are summarized in the subbasin chapters. In conjunction with the development of planning objectives, descriptions of major water resources problems and opportunities were prepared for each subbasin. They are presented in appendix D and highlighted in the respective subbasin chapters.

Recommended programs and conclusions and additional recommendations for each of the subbasins are presented in chapters 3 through 10.

This chapter presents basinwide components of the regional plan in three sections: recommended basinwide programs; recommended statewide programs; and conclusions and additional recommendations. Each recommended basinwide program relates to several or all of the eight subbasin plans presented in subsequent chapters of this report. Similarly, each recommended statewide program generally relates to two or more subbasins. Therefore, the complete plan for each subbasin consists of those elements specifically stated in the subbasin chapter as well as relevant basinwide and statewide recommendations in this chapter.

The basinwide and statewide recommendations address all the functions listed in the Introduction. Some of the recommended programs are particularly important to the Missouri River Basin and these are highlighted briefly. However, it is the total, coordinated implementation of all of these recommendations, not just those which are highlighted, which will serve to meet the future water resources management needs of the basin.

The importance of the first function addressed in the program recommendations, comprehensive planning and support activities, is partially illustrated by the relatively large number of recommended basinwide and statewide programs in this category. A firm understanding of the planning setting--water resources needs and opportunities, resource availability, planning objectives and policies, and management alternatives--is necessary as a sound basis for formulating and evaluating alternative courses of action. By evaluating these alternatives comprehensively, the interrelationships between alternatives and the cumulative effects of their implementation can be assessed

across functional lines. The resulting management plan can then be expected to recognize and make the tradeoffs necessary to best satisfy the region's needs and objectives. In the Missouri Basin, its subbasins, and States, much additional groundwork is needed in order to reach this desirable level of planning refinement.

Several recommended basinwide and statewide comprehensive planning programs play a particularly important role in meeting the basin's comprehensive planning needs. Perhaps the most central program is conducted under title III of the Water Resources Planning Act of 1965. This program is listed among the recommended basinwide programs. Title III and its amendments provide the authority for the Congress to appropriate funds to the U.S. Water Resources Council. These funds are in turn passed through to the States for use in State comprehensive planning and water conservation. Programs already developed by the States through this authority, shown in the recommended statewide programs, have greatly enhanced State water resources planning and management.

Another program which will advance comprehensive planning basinwide is the Missouri River Basin Hydrology Study. This study is being conducted by the Missouri River Basin Commission to prepare a basinwide hydrologic data base to be used to develop a computerized system for evaluating the hydrologic effects of water resources management alternatives.

A serious problem affecting most of the Missouri Basin States and many of their water resources management programs is uncertainty surrounding water rights associated with Indian and Federal lands. There is no authorized program to resolve this problem. Therefore, the first of the basinwide conclusions and additional recommendations is that the Commission should address this problem following the completion of the Missouri River Basin Hydrology Study in 1982. Implicit in this problem is the need to integrate planning activities for Indian lands into the comprehensive planning process.

A number of basinwide and statewide programs are recommended to address flooding problems in the Missouri Basin. These recommendations range from the structural programs of the Corps of Engineers and Soil Conservation Service to flood plain management programs administered by States and the Federal Emergency Management Agency. Efforts by the National Weather Service to improve flood forecasting techniques and effectiveness

supplement these structural and nonstructural measures. By addressing flooding problems through the vigorous implementation of these programs, flood damages can be controlled and, in some areas of the basin, even decreased.

Recognition of both Federal and State roles in promoting fish and wildlife resources in the Missouri Basin is reflected in the growing number and prominence of basinwide and statewide programs directed at better managing these resources. On the Federal side, Fish and Wildlife Service programs address virtually every aspect of fish and wildlife management, especially the protection of endangered species and migratory birds and the enhancement of the Missouri Basin's fisheries. On the State side, State agency programs are directed primarily at improving fisheries and hunting and protecting and managing nongame species.

Continued and wise development of irrigation is sought in many parts of the Missouri Basin. Agriculture is by far the predominant industry in the Missouri Basin. Irrigated lands can play an important role in the continued growth and prosperity of the basin.

Most of the irrigation facilities and structures already developed in the Missouri Basin were built or financed through either Federal or private efforts. State programs have not yet had major impact on irrigation. Large costs associated with major project construction has been one limiting factor. Also, much of the private development that has occurred serves only one or a few farmers.

Colorado and Wyoming are initiating programs for financing water development programs by taxing mineral development. However, in Colorado, Wyoming, and other basin States, future irrigation development will continue to depend largely on Federal and private investment. The relative importance of Federal irrigation programs, therefore, will continue to be great. This is reflected not only by the basinwide and statewide irrigation programs recommended for implementation, but also in the numerous irrigation programs recommended for individual subbasins. Most of these programs are those of the Water and Power Resources Service.

Land conservation and management has long been the function of a group of U.S. Department of Agriculture programs whose significance in the Missouri River Basin is well recognized.

These programs, which involve primarily the Soil Conservation Service and the Agricultural Stabilization and Conservation Service are directed not only at preserving the soil base but also at reducing the introduction of sediment into streams. Efforts to preserve the soil, therefore, serve also to improve water quality, which is increasingly important in the Missouri Basin.

Water supplies are both sparse and of poor quality in many rural areas where much of the Missouri Basin population resides. One pressing water resources need, therefore, is to improve municipal and domestic water supplies in rural areas. One of the most effective tools for addressing this need is the Farmers Home Administration assistance in building rural water and waste disposal systems, the basinwide program named, "Rural Water and Waste Disposal Systems". In many parts of the Missouri Basin this program provides the only source of funds for constructing needed water supply systems. It is a key program in the region's water resources management plan.

The perceived value of natural, historical, and cultural resources has grown noticeably during the last few years. This has led to the recognized need for preserving these resources to the maximum possible extent. Programs of the Forest Service, Heritage Conservation and Recreation Service, and National Park Service are oriented toward preserving wilderness areas and wild and scenic rivers and documenting and preserving the trails taken by early explorers of the Missouri River Basin. As institutions in the Missouri River Basin mature and development occurs, the value of these resources will grow, creating a greater need for advancing programs oriented toward preserving these limited resources.

Basinwide recommendations addressing development of hydroelectric and wind energy are of far reaching significance. Methods for utilizing these pollution free sources of energy are being and should continue to be promoted basinwide by the Water and Power Resources Service, Corps of Engineers, Western Area Power Administration, and the Bureau of Indian Affairs.

Most planning for water-associated outdoor recreation is conducted by the States with assistance from the Heritage Conservation and Recreation Service. The need for continuing such planning is specifically recognized in the recommended statewide programs. However, because the responsibility for conducting recreation planning rests primarily with the States,

an information base using consistent geographical units, units of measure, and groupings of data is not available for the entire Missouri River Basin. It is, therefore, suggested in the basinwide conclusions and additional recommendations that the Heritage, Conservation and Recreation Service initiate an effort to restructure the information bases of the individual States in order to construct a uniform recreation data base for the entire basin.

Concerns for water quality in the Missouri Basin have grown during the last few years. The need for careful water quality planning and implementation of water quality plans is now clearly recognized. Several Environmental Protection Agency and numerous State programs are designed to evaluate the extent of water quality problems in the Missouri River Basin and to explore ways for improving water quality. Many of the water quality problems in the Missouri Basin stem from nonpoint sources, mainly runoff from farm and range lands. The U.S. Department of Agriculture's Rural Clean Water Program, is a recommended basinwide program of considerable promise for addressing these pollution sources. This program should help to link efforts toward both land conservation and water quality enhancement. While the relationship between land conservation and water quality is reasonably well established, there are many other water resources functions which relate closely to water quality and water quality programs. These links suggest the need for better integrating water quality planning into the comprehensive planning process.

1/ The Missouri River Basin Comprehensive Framework Study, Vol. 1, Report (Missouri Basin Inter-Agency Committee, 1969), p. 58.

2/ Ibid, p. 63.

RECOMMENDED PROGRAMS - BASINWIDE

NAME, LEAD AGENCY, AND FUNCTIONS	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-MISSOURI RIVER BASIN HYDROLOGY STUDY Missouri River Basin Commission Comprehensive	Ongoing special study for FY 80 and 81 for the development of a hydrological accounting system for Missouri River Basin; total cost $2.3 million.
2-NATIONAL FOREST SYSTEM MANAGEMENT USDA/Forest Service Comprehensive	Ongoing implementation program that includes preparation of management plans for national forests and grasslands.
3-COOPERATIVE PROGRAMS USDA/Forest Service Comprehensive	Ongoing implementation program that provides assistance to states, private landowners, and local entities in forest protection and management, urban forestry, and rural fire protection.
4-YOUTH CONSERVATION CORPS USDA/Forest Service Comprehensive	Ongoing implementation program that provides work experience and training for youth in natural resources development and management and other skills.
5-RESOURCE CONSERVATION AND DEVELOPMENT (RC&D) PROGRAM USDA/Soil Conservation Service Comprehensive	Ongoing program of assistance to local groups in conserving and developing natural resources; specific programs are listed in each subbasin.
6-NATIONAL DAM SAFETY PROGRAM Army Corps of Engineers Comprehensive	Ongoing implementation program that includes an inventory and inspection of dams in potential high hazard areas.

7-WATER RESOURCES INVESTIGATIONS ON INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Comprehensive	Ongoing special study of water resources on Indian reservations that includes a four phase program; total cost $12 million; FY 81 cost $100,000.
8-RESOURCE INVENTORIES AND MANAGEMENT FRAMEWORK PLANS DOI/Bureau of Land Management Comprehensive	Ongoing river basin planning programs that include resource inventories, management framework plans, and environmental assessments on public lands; specific programs are listed in subbasins.
9-ENERGY MINERALS REHABILITATION INVENTORY AND ANALYSIS PROGRAM DOI/Bureau of Land Management Comprehensive	Ongoing special study of resource rehabilitation potential and impacts in the strippable coal region on BLM lands.
10-EXAMINATION OF EXISTING STRUCTURES PROGRAM; SAFETY OF DAMS DOI/Water and Power Resources Service Comprehensive	Ongoing implementation program to review structural and hydraulic adequacy of dams.
11-SMALL WATERSHED PROGRAM USDA/Soil Conservation Service Comprehensive	Ongoing implementation program to assist local organizations in watershed planning and construction; specific projects are shown in subbasins.
Assistance to State Water Planning	
12-TITLE III ASSISTANCE TO STATES U.S. Water Resources Council Comprehensive	Ongoing river basin planning program that provides financial assistance to States to develop water plans and to integrate programs that emphasize water conservation.
13-SECTION 22, ASSISTANCE TO STATE WATER PLANNING Army Corps of Engineers Comprehensive	Ongoing river basin planning program that provides technical planning assistance to States.
Support Activities	
14-TECHNICAL ASSISTANCE TO STATES DOI/Water and Power Resources Service Comprehensive	Ongoing river basin planning program that provides assistance to western States in the development of State water plans; FY 81 cost $150,000 for Lower Missouri Region.
15-CONSERVATION OPERATIONS USDA/Soil Conservation Service Comprehensive	Ongoing implementation program to provide technical assistance in use of soil, water, and plant and animal resources.

16-SOIL SURVEYS USDA/Soil Conservation Service Comprehensive	Ongoing data collection program that assesses and maps soil characteristics and capabilities for use in planning programs.
17-RESOURCE AND ENVIRONMENTAL STUDIES DOI/Bureau of Mines Comprehensive	Ongoing river basin planning program that includes studies of mineral resources and water supplies relating to mineral development and exploration.
18-TOPOGRAPHIC MAPPING DOI/Geological Survey Comprehensive	Ongoing data collection program to prepare and update topographic maps.
19-GROUND-WATER STATIONS DOI/Geological Survey Comprehensive	Ongoing data collection program to obtain data on ground water use and availability in order to provide a base for ground water planning and development.
20-WATER QUALITY STATIONS DOI/Geological Survey Comprehensive	Ongoing data collection program to develop a data bank for water resources planning and management.
21-STREAM GAGING STATIONS DOI/Geological Survey Comprehensive	Ongoing data collection program of surface water data for planning and management purposes.
22-NATIONAL WATER USE DATA SYSTEM DOI/Geological Survey Comprehensive	Ongoing data collection and research program in cooperation with States to develop uniform and reliable water use data for Missouri River Basin States; FY 80 cost $1,924,000.
23-SEDIMENT STATIONS DOI/Geological Survey Comprehensive	Ongoing data collection program to develop a data bank on stream sedimentation for use in water resources planning.
24-FLOOD PLAIN MANAGEMENT SERVICES Army Corps of Engineers Comprehensive	Ongoing data collection program to provide information to agencies and communities for flood plain management; FY 81 cost $542,000; FY 82 cost $514,000.

25-FISH AND WILDLIFE RESEARCH PROGRAMS DOI/Fish and Wildlife Service Comprehensive	Ongoing research program on ecologies, species, relationships, and species' responses to land management alternatives.
26-STANDARD HABITAT CLASSIFICATION SYSTEM DOI/Fish and Wildlife Service Comprehensive	New start special study to develop uniform system for classifying wildlife habitat.
27-WATER RESOURCES PLANNING AND ENGINEERING RESEARCH DOI/Water and Power Resources Service Comprehensive	Ongoing special study of water resources research to improve planning, design, construction, and operation and maintenance of water resources projects; FY 81 cost $4 million.
28-RESEARCH IN WATER AND RELATED LAND RESOURCES DOI/Office of Water Research and Technology Comprehensive	Ongoing research program that funds projects in water resources research institutes.
29-BASIC WEATHER OBSERVATIONS DOC/National Weather Service Comprehensive	Ongoing data collection program to provide weather data for forecasting and related purposes; cost averages $4.3 million per year.
30-AUTOMATIC HYDROLOGIC OBSERVATION SYSTEM DOC/National Weather Service Comprehensive	Ongoing data collection program providing telemetered river and rainfall information; cost averages $1.4 million per year for each State.
31-VECTOR CONTROL HHS/Public Health Service Comprehensive	Ongoing implementation program to inventory and analyze potential disease vectors with emphasis on water bodies.

FLOODING

32-SECTION 205, SMALL FLOOD CONTROL PROJECTS Army Corps of Engineers Flooding	Ongoing implementation program to construct projects up to $2 million or $3 million for disaster areas; specific projects are shown in subbasins.
33-SECTION 208, SNAGGING AND CLEARING PROJECT FOR FLOOD CONTROL Army Corps of Engineers Flooding	Ongoing implementation program to straighten and clear channels to alleviate flooding; cost limited to $250,000 per project, national program limited to $10 million per year.
34-SECTION 14, EMERGENCY BANK PROTECTION Army Corps of Engineers Flooding	Ongoing implementation program to protect stream-banks in order to prevent damage; cost limited to $250,000 per project, national program limited to $10 million a year.
35-RIVER AND FLOOD FORECASTING AND WARNING DOC/National Weather Service Flooding	Ongoing implementation program to provide forecasts and warnings to public and operational agencies; cost $600,000 per year.
36-NATIONAL FLOOD INSURANCE PROGRAM Federal Emergency Management Agency Flooding	Ongoing implementation program to provide flood insurance and flood plain management.
37-FLOOD PLAIN MANAGEMENT ASSISTANCE PROGRAM USDA/Soil Conservation Service Flooding	Ongoing special studies identifying flooding problems and management alternatives; cost-shared with local governments.

FISH AND WILDLIFE

38-WATER BANK PROGRAM USDA/Agricultural Stabilization and Conservation Service Fish and Wildlife	Ongoing implementation program to identify and preserve wetlands; costs vary with States.
39-ENDANGERED SPECIES DOI/Fish and Wildlife Service Fish and Wildlife	Ongoing program implementation to plan, coordinate, and manage habitat for endangered species.
40-MIGRATORY BIRDS DOI/Fish and Wildlife Service Fish and Wildlife	Ongoing implementation program to maintain migratory bird population; FY 79 cost $7,250,000, future years undetermined.
41-FISHERY RESOURCES PROGRAM DOI/Fish and Wildlife Service Fish and Wildlife	Ongoing implementation program to establish and enhance sport fish population and recreational fishing opportunities; costs vary with facility.
42-WETLAND HABITAT INVENTORY DOI/Fish and Wildlife Service Fish and Wildlife the early spring.	Ongoing inventory of all wetlands of the U.S. using color infrared and black and white aerial phographs as primary inventory tool. Flights are flown in

IRRIGATION

43-IRRIGATION FACILITIES REHABILITATION AND BETTERMENT PROGRAM DOI/Water and Power Resources Service Irrigation	Ongoing feasibility studies to modernize and improve irrigation facilities through a loan program; total cost $6.1 million.
44-SMALL RECLAMATION PROJECTS LOAN PROGRAM DOI/Water and Power Resources Service Irrigation	Ongoing feasibility studies for irrigation or multipurpose projects for local districts with Federal loans.
45-WATER MANAGEMENT STUDY OF THE HIGH PLAINS DOI/Geological Survey Irrigation	Ongoing special study to define hydrologic characteristics of Ogallala formation and evaluate effects of different management practices; FY 80 cost $50,000.

46-HIGH PLAINS STUDY DOC/Economic Development Administration Irrigation	Ongoing special study to determine economic effects of declining ground water levels in the High Plains; total cost $6.1 million.

LAND CONSERVATION AND MANAGEMENT

47-RESOURCE INVENTORY AND MONITORING USDA/Soil Conservation Service Land Conservation & Management	Ongoing data collection program to report current conditions of land use, erosion, and treatment; costs vary in States.
48-AGRICULTURAL CONSERVATION PROGRAM USDA/Agricultural Stabilization and Conservation Service Land Conservation & Management	Ongoing implementation program to provide funding for carrying out conservation practices on agricultural land.
49-SHELTERBELT DEVELOPMENT PROGRAM USDA/Agricultural Stabilization and Conservation Service Land Conservation & Management	Ongoing implementation program to assist landowners in developing new shelterbelts.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

50-RURAL WATER AND WASTE DISPOSAL SYSTEMS USDA/Farmers Home Administration Municipal & Industrial Rural Supply	Ongoing implementation program to provide loans and grants to develop water supply and waste treatment facilities in rural areas; costs vary in States.
51-WATER AND WASTEWATER SYSTEMS ON INDIAN RESERVATIONS HHS/Indian Health Service Municipal & Industrial Rural Supply, Water Quality	Ongoing implementation program to assist reservation communities, homesteads in securing water supplies; costs vary.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

52-WILDERNESS AREA RECOMMENDATIONS USDA/Forest Service Natural, Historic, & Cultural	Ongoing feasibility study required by Congress of wilderness areas related primarily to national forest system lands. Costs vary.

53-WILD AND SCENIC RIVER RECOMMENDATIONS USDA/Forest Service Natural, Historic, & Cultural	Ongoing feasibility study of wild and scenic rivers required by Congress, related primarily to national forest lands; costs vary.
54-WILD AND SCENIC RIVER SYSTEM PLANNING DOI/Heritage Conservation and Recreation Service Natural, Historic, & Cultural	Ongoing feasibility study of rivers and streams with potential for addition to national wild and scenic river system; costs average $3,000 per State per year.
55-LEWIS AND CLARK NATIONAL HISTORICAL TRAIL DOI/National Park Service Natural, Historic, & Cultural	Ongoing implementation of program to develop features along historical water trail; cost to be determined.

POWER AND ENERGY

56-ENERGY DEVELOPMENT ON INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Power and Energy	Ongoing feasibility study investigating potential energy development on Indian reservations.
57-SECTION 167, HYDROELECTRIC POWER RESOURCES UTILIZATION Army Corps of Engineers Power and Energy	Ongoing special study to evaluate the feasibility of adding hydrologic generating facilities at existing and selected potential dam sites; total cost $7 million.
58-WESTERN HYDROELECTRIC POWER INVENTORY SPECIAL STUDY DOI/Water and Power Resources Service Power and Energy	New start special study to evaluate lowhead hydroelectric development in 17 western States; total cost $963,000.
59-REGIONAL WIND ENERGY STUDY DOI/Water and Power Resources Service Power and Energy	New start data collection of wind energy at various locations throughout Missouri River Basin with potential for wind generation of electricity; total cost $8 million.
60-HYDROPOWER RESOURCES DEVELOPMENT DOE/Federal Energy Regulatory Commission Power and Energy	Ongoing program of compiling data on the capacity, generation, construction and operating costs of hydroelectric resources, including pumped storage resources.
61-REEVALUATION OF HYDROPOWER SITES DOE/Federal Energy Regulatory Commission Power and Energy	New start special study of compiling and providing information to facilitate the reactivation of retired hydropower sites.

WATER-ASSOCIATED OUTDOOR RECREATION

TRANSPORTATION

62-SECTION 158, WATERWAYS SYSTEM ASSESSMENT Army Corps of Engineers Transportation	Ongoing special study to assess current national waterway system and its capacity to meet current and projected transportation needs; total cost $6 million.

WATER QUALITY

63-IMPLEMENTATION OF WATER QUALITY PLANS Environmental Protection Agency Water Quality	Ongoing program to implement water quality management plans; costs vary by State.
64-SECTION 201, WASTE TREATMENT FACILITY CONSTRUCTION GRANTS Environmental Protection Agency Water Quality	Ongoing implementation of program that assists local agencies in the planning and construction of waste treatment facilities; costs vary by State.
65-CLEAN LAKES PROGRAM Environmental Protection Agency Water Quality	Ongoing special study that inventories lakes and implements methods for controlling and improving water quality; costs vary by State.
66-RURAL CLEAN WATER PROGRAM USDA/Agricultural Stabilization and Conservation Service Water Quality	New start implementation program that provides technical and cost-share assistance in controlling nonpoint source pollution.

LEGAL AND INSTITUTIONAL FACTORS

INSTREAM FLOWS

67-DETERMINATION OF MINIMUM INSTREAM FLOW NEEDS
DOI/Fish and Wildlife Service
Instream Flows

Ongoing research program to determine minimum streamflow levels for various instream uses. FWS's Cooperative Instream Service Group; annual funding $730,000.

WEATHER MODIFICATION

68-HIGH PLAINS COOPERATIVE PROGRAM
DOI/Water and Power Resources Service
Weather Modification

Ongoing research program that develops cloud seeding capability for increasing useful summer rainfall over semiarid High Plains; FY 81 cost $8.6 million.

69-WEATHER MODIFICATION RESEARCH
DOC/National Weather Service
Weather Modification

New start research program for weather modification involving North Dakota and Utah; total cost $1.2 million.

RECOMMENDED PROGRAMS - STATEWIDE

NAME, LEAD AGENCY, AND FUNCTIONS	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
Colorado	
1-COMPREHENSIVE WATER PLANNING, COLORADO Colorado Dept. of Nat. Res./Water Conservation Bd. Comprehensive	Ongoing statewide comprehensive water resources planning; interstate compact admin; flood plain designation, EIS, instream flow and lake level studies, FY 80 cost $1.1 million.
2-STREAM GAGING AND SEDIMENT STATIONS Colorado Dept. of Nat. Res./Water Conservation Bd. Comprehensive	Ongoing data collection; cooperative stream gaging program with USGS and CODNR/ DWR; FY 80 total state cost $222,500.
3-GROUND WATER DATA COLLECTION NETWORK Colorado Dept. of Nat. Res./Div. of Water Resources Comprehensive	Ongoing data collection; measurement of ground water levels, development of water level maps & hydrographs; cooperative program with USGS; cost $820,000 per year.
4-STATEWIDE GROWTH AND HUMAN SETTLEMENT PROGRAM Colorado Dept. of Local Affairs/Div. of Planning Comprehensive	Ongoing data collection; investigation and recommendations of growth policies; cooperative with HUD; FY 80 cost $50,000.
Iowa	
5-WATER DATA COLLECTION ACTIVITIES Iowa Natural Resources Council Comprehensive	Ongoing data collection of surface and ground water use for water resources planning and design.

6-COOPERATIVE SOIL SURVEY PROGRAM Iowa Soil Conservation Department Comprehensive	Ongoing data collection; conduct soil survey investigations in field in cooperation with SCS; FY 80 cost $326,000.
7-COUNTY GROUND WATER AVAILABILITY RESEARCH Iowa Geological Survey Comprehensive	Ongoing data collection to prepare regional ground water atlas for local agency and water related industry use; cost per year $26,000.

Kansas

8-STATE WATER PLANNING Kansas Water Resources Board Comprehensive	Ongoing regional planning; interdisciplinary program designed to resolve conflicts & problems; formulation & modification of water policy & objectives; WRC grant FY 80 $80,000; state cost FY 80 $105,000.
9-SPECIAL STUDIES Kansas Water Resources Board Comprehensive	Ongoing special study; hydrology, economics modeling, inventories, & field investigation to provide guidance to State agencies, gov., legislature & political subdivisions; FY 80 cost $26,000.
10-USGS COOPERATIVE PROGRAM Kansas Water Resources Board Comprehensive	Ongoing data collection; basic data collection streamflow and sediment; FY 80 cost $299,000.
11-WATER PLANNING COORDINATION Kansas Water Resources Board Comprehensive	Ongoing program implementation; coordinate local, State, Federal, & regional programs and plans; FY 80 cost $283,000.
12-APPLIED AND BASIC GROUND WATER RESEARCH Kansas Geological Survey Comprehensive	Ongoing research; ground water investigations, develop new geophysical & geochemical techniques, models; investigate problem systems, forecasts, FY 80 cost $147,000.

13-SPECIAL PROJECTS
Kansas Bd. of Agriculture/Div. of Water Resources
Comprehensive

Ongoing special study; program to monitor ground water areas to determine level changes and development potential; administer 4 interstate compacts; FY 80 cost $68,000.

14-NATIONAL DAM INSPECTION PROGRAM
Kansas Bd. of Agriculture/Div. of Water Resources
Comprehensive

Ongoing program implementation; determine number of existing dams, inspect & report conditions of "high hazard" dams; COE cost FY 80 $347,000; total cost COE $993,000.

Minnesota

15-MINNESOTA LAND MANAGEMENT INFORMATION SYSTEM
Minnesota State Planning Agency
Comprehensive

Ongoing continuing data collection; statewide land & water inventory on a 40-acre parcel data cell; cost FY 80 $550,000; total cost-State $862,473, Fed $206,536; project total $1.1 million.

16-FEDERAL PROGRAM COORDINATION
Minnesota Dept. of Nat. Res/Div. of Waters
Comprehensive

Ongoing river basin planning; coordinate the department role in Federal programs and regulations; FY 80 cost $35,000.

17-FRAMEWORK WATER AND RELATED LAND RESOURCES PLANNING
Minnesota Water Planning Board
Comprehensive

Ongoing river basin planning; development of programs and policies for the management of water and related land resources; WRC FY 80 match $60,000; MWPB FY 80 cost $288,000.

18-STREAM HYDROLOGY PROGRAM
Minnesota Dept. of Nat. Res./Div. of Waters
Comprehensive

Ongoing continuing data collection; promotion of of wise use of water through understanding and monitoring the stream hydraulic system; FY 80 cost $204,000.

19-GROUND WATER HYDROLOGY PROGRAM Minnesota Dept. of Nat. Res./Div. of Waters Comprehensive	Ongoing data collection; promotion of wise use of water through understanding and monitoring the ground water hydraulic system; FY 80 cost $500,000; total cost $810,000.
20-STATE CLIMATOLOGY PROGRAM Minnesota Dept. of Nat. Res./Div. of Waters Comprehensive	Ongoing continuing data collection program to provide needed information and expertise on meteorology & climatology; FY 80 cost $70,000.

Missouri

21-STATE WATER PLANNING PROGRAM Missouri Dept.of Nat.Res./Div.of Planning & Policy Dev.	Ongoing state comprehensive water resources planning; FY 80 cost $60,000.
22-COOPERATIVE SOIL SURVEY PROGRAM Missouri Dept.of Nat.Res./Div.of Environmental Quality Comprehensive	Ongoing continuing data collection; conduct soil survey investigations in field in cooperation with SCS; FY 80 cost $433,000.
23-GEOLOGICAL WATER DATA COLLECTION ACTIVITIES Missouri Dept.of Wat.Res./Div. of Geology & Land Survey Comprehensive	Ongoing data collection of mineral and energy resources,engineering geology, and geological investigations; FY 80 cost $1.6 million.

Montana

24-STATE WATER PLANNING Montana Dept. of Nat. Res. and Conservation Comprehensive	Ongoing river basin planning; development of State water plan; FY 80 cost $500,000; WRC match FY 80 $107,000.

Nebraska

25-NATURAL RESOURCES DATA BANK Nebraska Natural Resources Commission Comprehensive	Ongoing data collection; compile and make available statewide natural resource data; cost per year $70,000.
26-STATE WATER PLANNING AND REVIEW PROCESS Nebraska Natural Resources Commission Comprehensive	Ongoing special study; process incl. policy issues analysis & recommendations, problem analysis & area planning, project planning and design; FY 80 cost $348,000.
27-BASIC WATER MONITORING PROGRAM Nebraska Dept. of Environmental Control Comprehensive	Ongoing data collection; includes discharge permits, water quality assessments, management strategies; FY 80 cost $130,000.
28-DATA COLLECTION/WATER USE Nebraska Conservation and Survey Div. Comprehensive	Ongoing data collection; water use data collection storage, manipulation and dissemination; FY 80 cost $60,000.
29-SPECIAL GEOHYDROLOGY STUDIES Nebraska Conservation and Survey Div. Comprehensive	Ongoing special studies; test drilling; modeling in Twin Platte and Republican NRD's; FY 80 cost $80,000.
30-REMOTE SENSING PROGRAM Nebraska Conservation and Survey Div. Comprehensive	Ongoing data collection; land use and resource inventories; FY 80 cost $100,000.
31-STREAM GAGING STATIONS Nebraska Dept. of Water Resources Comprehensive	Ongoing data collection; collect surface water data; cooperative with USGS; FY 80 cost $427,000.

32-TEST HOLE DRILLING PROGRAM Nebraska Conservation and Survey Div. Comprehensive	Ongoing data collection; stratigraphic investigations; FY 80 cost $30,000.
33-GROUND WATER STATIONS Nebraska Conservation and Survey Div. Comprehensive	Ongoing data collection; cooperative program with USGS & DWR; collect ground water level data for planning and management.
34-WATER QUALITY STATIONS Nebraska Natural Resources Commission Comprehensive	Ongoing data collection; cooperative program with USGS to provide water quality data for planning and management; FY 80 cost $70,000.
35-SOIL SURVEYS Nebraska Conservation and Survey Div. Comprehensive	Ongoing data collection; cooperative soil mapping and interpretations; cost FY 80 $410,000.
North Dakota	
36-STATE WATER MANAGEMENT PLANNING PROGRAM North Dakota State Water Commission Comprehensive	Ongoing river basin planning; comprehensive State water resource planning; WRC FY 80 grant $60,000; state cost $120,000.
37-WATER RESOURCES INVESTIGATIONS North Dakota State Water Commission Comprehensive	Ongoing data collection and analysis; water supply & quality information; coop with USGS; annual cost $841,000.
South Dakota	
38-STATE WATER PLANNING South Dakota Dept. of Water and Natural Resources Comprehensive	Ongoing river basin planning for conservation, development, and management of all waters; FY 80 cost, WRC $171,000; South Dakota $171,000; FmHA $50,000; OWRC $75,000; total $467,000.

39-COMPREHENSIVE PLANNING PROGRAM South Dakota State Planning Bureau Comprehensive	Ongoing regional planning; State and local comprehensive plans and resource management programs; funds from FmHA, OWRC, others; SD DWNR cost FY 80 $90,000; total cost FY 80 $144,000.
40-COUNTY GROUND WATER STUDIES South Dakota Dept. of Water and Natural Resources Comprehensive	Ongoing data collection; financial and technical assistance in ground water studies; State share 75%; conservancy subdistricts share 25%, total FY 80 cost $774,000.
41-LAND COVER INVENTORY South Dakota State Planning Bureau Comprehensive	Ongoing data collection; compilation of land cover maps and statistics using remote sensing techniques; cost $110,000 annually.
42-WATER RIGHTS PROGRAM South Dakota Dept. of Water and Natural Resources Comprehensive	Ongoing program implementation; control and regulate the development, conservation, and allotment of surface and underground waters; cost $465,000 annually.
Wyoming	
43-STATE WATER PLANNING PROGRAM Wyoming Water Development Commission Comprehensive	Ongoing feasibility study to develop, maintain and update the State water plan & conduct project feasibility studies; FY 80 cost $610,000.
44-STATE COOPERATIVE STREAM GAGING & GROUND WATER MONITORING State Engineer's Office Comprehensive	Ongoing data collection; cooperative program with USGS; record stream stages, discharge quality, and monitor ground water resources.

FLOODING

Iowa

45-FLOOD PLAIN MANAGEMENT PROGRAM
Iowa Natural Resources Council
Flooding

Ongoing program of flood plain regulation; coordination of National Flood Insurance Program; FY 80 cost $24,000.

Kansas

46-WATERSHED PLANNING
Kansas State Conservation Commission
Flooding

Ongoing feasibility studies; assistance in Federal and non-Federal watershed projects; FY 80 cost $120,000.

47-FLOOD PLAIN MANAGEMENT
Kansas Bd. of Agricultural/Div. of Water Resources
Flooding

Ongoing program to coordinate FEMA national flood insurance program; reviews regulation and plans; FY 80 cost $48,000.

Minnesota

48-FLOOD PLAIN MANAGEMENT PROGRAM
Minnesota Dept. of Nat. Res./Div. of Waters
Flooding

Ongoing program to coordinate National Flood Insurance Program with FEMA; FY 80 cost $155,000.

Montana

49-FLOODWAY MANAGEMENT AND REGULATION PROGRAM
Montana Dept. of Nat. Res. and Conservation
Flooding

Ongoing feasibility studies; delineation and regulation of flood plain; cost $140,000 annually.

50-DAM SAFETY PROGRAM
Montana Dept. of Nat. Res. and Conservation
Flooding

Ongoing special studies; inspection of State-owned flood protection structures; cost $26,000 annually.

Nebraska

51-LOCAL PLANNING ASSISTANCE FOR SPECIAL PROJECTS
Nebraska Natural Resources Commission
Flooding

Ongoing data collection; topographic surveys and photographic assistance to aid local water projects; cost $85,000 annually.

52-SMALL WATERSHED FLOOD CONTROL FUND
Nebraska Natural Resources Commission
Flooding

Ongoing program implementation; financial assistance for local watershed project development; FY 80 cost $961,000.

53-FLOOD PLAIN MANAGEMENT PROGRAM
Nebraska Natural Resources Commission
Flooding

Ongoing program implementation; flood plain delineation for zoning and management; cost $85,000 annually.

54-RESOURCES DEVELOPMENT FUND
Nebraska Natural Resources Commission
Flooding

Ongoing program implementation; cooperative State/local watershed project development; FY 80 State cost $1,250,000; local NRD cost FY 80 $615,000; total cost FY 80 $1.9 million.

South Dakota

55-MAGNITUDE & FREQUENCY OF FLOODS IN SELECT DRAINAGE BNS;SD
South Dakota Dept. of Transportation
Flooding

Ongoing research to determine 50- and 100-year floods for selected basins; to be used in planning and design; USGS share FY 80 $16,200; SDDOT FY 80 cost $16,200.

56-DAM SAFETY PROGRAM
South Dakota Dept. of Water and Natural Resources
Flooding

Ongoing program implementation; inspection of water impoundment structures; cost $121,700 annually.

Wyoming

57-DAM SAFETY PROGRAM
Wyoming State Engineer
Flooding

Ongoing program implementation inspection of water impoundment structures; cost $35,000 annually.

FISH AND WILDLIFE

Colorado

58-HABITAT IMPROVEMENT ON PUBLIC LANDS
Colorado Dept. of Nat. Res./Div. of Wildlife
Fish and Wildlife

Ongoing program implementation; habitat improvement on public lands; FY 80 cost $50,000.

59-LAND ACQUISITION PROGRAM
Colorado Dept. of Nat. Res./Div. of Wildlife
Fish and Wildlife

Ongoing program implementation; acquisition & development of land to preserve wildlife populations & provide public access; cost $1 million annually.

Kansas

60-PUBLIC LAND AND WATER MANAGEMENT
Kansas Fish and Game Commission
Fish and Wildlife

Ongoing program implementation; maintenance, improvement and management of hunting and fishing lands and waters; USDOI share 50%; KFGC FY 80 cost $1,072,000; total FY 80 cost $2.1 million.

61-ENVIRONMENTAL AND TECHNICAL SERVICES
Kansas Fish and Game Commission
Fish and Wildlife

Ongoing program implementation; provide information on fish and wildlife resources to water resources planning and management; USDOI share FY 80 $84,000; KFGC FY 80 $29,000.

Minnesota

62-WILDLIFE MANAGEMENT PROGRAM Minnesota Dept. of Nat. Res./Div. of Fish & Wildlife Fish and Wildlife	Ongoing program implementation; statewide program to maintain productive wildlife populations; habitat protection; FY 80 cost $5.4 million.
63-FISH MANAGEMENT PROGRAM Minnesota Dept. of Nat. Res./Div. of Fish & Wildlife Fish and Wildlife	Ongoing program implementation; statewide program to maintain productive fish populations and to develop adequate data from lake & stream surveys; FY 80 cost $5.1 million.

Missouri

64-DESIGN FOR CONSERVATION-LAKE DEVELOPMENT STUDY Missouri Dept. of Conservation Fish and Wildlife	Ongoing feasibility study to provide fishing lakes; total cost $750,000.
65-DESIGN FOR CONSERVATION-STREAM ACCESS & FRONTAGE STUDY Missouri Dept. of Conservation Fish and Wildlife	Ongoing feasibility study to provide access to floatable and nonfloatable streams; FY 79 budgeted cost $2.3 million.
66-DESIGN FOR CONSERVATION-WATERFOWL ACCESS STUDY Missouri Dept. of Conservation Fish and Wildlife	Ongoing feasibility study; purchase, develop, and operate five new waterfowl areas; budgeted FY 79 $1.5 million.

Montana

67-FISH PROGRAMS AND ECOLOGICAL SERVICES Montana Dept. of Fish, Wildlife and Parks Fish and Wildlife	Ongoing program implementation; State programs dealing with fish and ecological services; FY 80 cost $3 million.

68-WILDLIFE PROGRAMS Montana Dept. of Fish, Wildlife and Parks Fish and Wildlife	Ongoing program implementation; statewide wildlife program; annual cost $2.6 million.

Nebraska

69-HABITAT PROGRAM Nebraska Game and Parks Commission Fish and Wildlife	Ongoing program implementation; acquisition and development of wildlife acreage; FY 80 cost $2.5 million.

Wyoming

70-FISH AND WILDLIFE PLANS,PROGRAMS,AND IMPLEMENTATION Wyoming Game and Fish Department Fish and Wildlife	Ongoing feasibility study; Wyoming strategic plan for fish and wildlife management.

IRRIGATION

Colorado

71-WATER PROJECT CONSTRUCTION FUND PROGRAM Colorado Dept. of Nat. Res./Water Conservation Board Irrigation	Ongoing program implementation; cooperative State/local water project development; uses mineral severance tax revenue; FY 80 cost $10.5 million.
72-AQUIFER RECHARGE Colorado Dept. of Nat. Res./Div. of Water Resources Irrigation	Ongoing special study; pilot project for recharging the Ogallala aquifer with surplus surface water; cost $10,000 annually.

Montana

73-SMALL WATERSHEDS PROGRAM
Montana Dept. of Nat. Res. and Conservation
Irrigation

Ongoing program implementation; State assistance to small watersheds; annual cost $62,500.

South Dakota

74-CONSERVANCY SUBDISTRICT STUDIES
South Dakota Dept. of Water & Nat. Resources
Irrigation

Ongoing feasibility studies; assembly of data and feasibility of project implementation; FY 80 cost $240,000.

Wyoming

75-STATE WATER DEVELOPMENT PROGRAM
Wyoming Water Development Commission
Irrigation

Ongoing program implementation; design & construction of water projects; funds from coal severance tax revenue; FY 80 cost $7.6 million.

LAND CONSERVATION AND MANAGEMENT

Iowa

76-COST SHARE PROGRAM
Iowa Soil Conservation Dept.
Land Conservation and Management

Ongoing program implementation; provide funds to landowners for land treatment measures; annual cost $5 million.

77-SMALL WATERSHED PLANNING AND DEVELOPMENT PROGRAM
Iowa Soil Conservation Dept.
Land Conservation and Management

Ongoing feasibility studies; accelerated watershed planning; annual cost $25,000.

Minnesota

78-SOIL AND WATER CONSERVATION COST-SHARING PROGRAM
Minnesota Soil and Water Conservation Board
Land Conservation and Management

Ongoing program implementation to educate & inform private landowners about conservation practices & give technical assistance in planning & applying conserv. measures; FY 80 cost $2.6 million.

Missouri

79-SMALL WATERSHED PLANNING AND DEVELOPMENT PROGRAM Missouri Dept. of Nat. Res./Div. of Environ. Quality Land Conservation and Management	Ongoing feasibility studies; accelerated watershed planning; annual cost $300,000.

South Dakota

80-EROSION AND SEDIMENT CONTROL PROGRAM South Dakota Dept. of Agriculture Land Cmnservation and Management	Ongoing program implementation; program to control erosion and reduce sedimentation; cost shared by USDA FY 80 $89,000 and counties FY 80 $280,000 total cost FY 80 $369,000.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER

Colorado

81-WATER USE INVENTORY Colorado Dept. of Nat. Res./Div. of Water Resources M&I Rural Supply	Ongoing continuing data collection; to determine feasibility of applying municipal water conservation measures; annual cost $95,000.

Kansas

82-RURAL WATER DISTRICTS Kansas Bd. of Agriculture/Div. of Water Resources M&I Rural Supply	Ongoing program implementation; financial assistance to rural water districts for plans and construction of water supply and distribution facilities; annual cost $1 million.
83-WATER MARKETING Kansas Water Resources Board M&I Rural Supply	Ongoing program implementation; sale of water from State-controlled conservation storage in major Federal reservoirs; KWRB FY 80 cost $1.5 million.
84-BUREAU OF WATER SUPPLY Kansas Dept. of Health and Environment M&I Rural Supply and Water Quality	Ongoing program implementation; surveillance of public water supplies and promotion of const. of treatment facilities and development of new sources of water;cost $187,000 annually; EPA FY80 $317,000.

Missouri

85-RURAL WATER SUPPLY AND SEWAGE SYSTEMS
Missouri Dept. of Nat. Res./Div. of Environ. Quality
M&I Rural Supply and Water Quality

Ongoing program implementation; cash contributions for system construction; guaranteed loans & grants; DNR FY80 cost $1.7 million; FmHA FY80 cost $15.6 million.

Nebraska

86-SAFE DRINKING WATER ACT
Nebraska Dept. of Health
M&I Rural Supply

Ongoing program implementation; supervise management of public water supplies; plan for correction of problems; FY 80 cost $115,000.

South Dakota

87-SECOND-STAGE AQUIFER STUDIES
South Dakota Dept. of Water and Natural Resources
M&I Rural Supply

Ongoing intensive aquifer studies (including test drilling and computer modeling) to supplement information from county ground water studies.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

North Dakota

88-STATE NATURAL AREA SYSTEMS
North Dakota Dept. of Parks and Recreation
Nat. Hist. & Cult.

New start feasibility studies to establish a system of natural preserves; total cost $200,000.

WATER-ASSOCIATED OUTDOOR RECREATION

Colorado

89-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Colorado Division of Parks and Recreation
Recreation

Ongoing special studies; plan and coordinate recreation and update State comprehensive outdoor recreation plan.

Iowa

90-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Iowa State Conservation Commission
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan.

Kansas

91-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Kansas Park and Resources Authority
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan; total FY 80 cost $145,000.

Minnesota

92-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Minnesota Dept.of Nat.Res./Bur.of Planning & Research
Recreation

Ongoing special studies; updating of Minnesota SCORP; cost FY 80 $173,800.

Missouri

93-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Missouri Department of Natural Resources
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan.

Montana

94-PARKS AND RECREATION PROGRAMS
Montana Dept. of Fish, Wildlife and Parks
Recreation

Ongoing special studies; planning, development implementation of programs and facilities; FY 80 cost $1,930,000.

Nebraska

95-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Nebraska Game and Parks Commission
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan.

North Dakota

96-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
North Dakota Department of Parks and Recreation
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan.

South Dakota

97-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
South Dakota Department of Game, Fish, and Parks
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan.

Wyoming

98-ACCESSS TO RIVERS AND STREAMS AND LAND ACQUISITION
Wyoming Game and Fish Dept.
Recreation

Ongoing program implementation; program to develop recreation access; annual cost $500,000.

99-STATE COMPREHENSIVE OUTDOOR RECREATION PLANNING
Wyoming Game and Fish Dept.
Recreation

Ongoing special studies; plan and coordinate recreation and update the State comprehensive outdoor recreation plan.

WATER QUALITY

Kansas

100-AGRICULTURAL RUNOFF WATER QUALITY MANAGEMENT
Kansas State Conservation Commission
Water Quality

Ongoing program implementation; land treatment to alleviate nonpoint pollution; FY 80 cost $70,000.

101-WATER QUALITY MANAGEMENT
Kansas Dept. of Health and Environment
Water Quality

Ongoing special study; identification of critical water quality & use problems & establish priorities of treatment programs; KDHE FY 80 cost $350,000; EPA cost FY 80 $430,000.

Minnesota

102-WATER QUALITY MONITORING PROGRAM
Minnesota Pollution Control Agency
Water Quality

Ongoing data collection and program implementation program to establish water quality and effluent standards & to monitor & enforce those standards; annual cost $700,000.

Montana

103-POLLUTION DISCHARGE ELIMINATION SYSTEM Montana Dept. of Health and Environmental Sciences Water Quality	Ongoing program implementation; prevent and eliminate point source pollution thru permits and regulations; annual cost $185,000.

Nebraska

104-CLEAN LAKES PROGRAM Nebraska Dept. of Environmental Control Water Quality	Ongoing program implementation; classification and survey of publicly owned lakes; FY 80 cost $67,000.
105-STATE WATER QUALITY MANAGEMENT Nebraska Department of Environmental Control Water Quality	Ongoing program implementation; water quality planning and coordination; cost FY 80 $120,000; EPA $50,000.

North Dakota

106-NONPOINT SOURCE POLLUTION MANAGEMENT North Dakota Dept. of Health Water Quality	Ongoing program implementation; program to identify nonpoint pollutant sources and to develop plans for controlling those pollutants.

South Dakota

107-CLEAN LAKES PROGRAM South Dakota Dept. of Water and Natural Resources Water Quality	Ongoing program implementation; pollution control measures to improve water quality in lakes; annual DWNR cost $300,000; EPA $600,000, local $300,000.
108-NONPOINT SOURCE POLLUTION MANAGEMENT South Dakota Dept. of Water and Natural Resources Water Quality	Ongoing program implementation;program to identify nonpoint pollution sources and to develop plans for controlling those pollutants.
109-DRINKING WATER QUALITY South Dakota Dept. of Water and Natural Resources Water Quality	Ongoing program implementation; improvement of the quality of water supply in small communities; annual cost $7,000.
110-STATEWIDE SOLID WASTE MANAGEMENT South Dakota Dept. of Health Water Quality	Ongoing program implementation; control and regulation of solid waste to prevent pollution of waters; annual State cost $78,000; EPA cost $143,000.

Wyoming

111-CHEMICAL WATER QUALITY PROGRAM
Wyoming Dept. of Agriculture
Water Quality
Ongoing continuing data collection; monitoring of water quality for agriculture.

LEGAL AND INSTITUTIONAL FACTORS

South Dakota

112-HIGH WATER MARKS
South Dakota Dept. of Water and Natural Resources
Legal and Institutional
New start data collection; monitoring of public lake levels; cost FY 80 $71,400.

INSTREAM FLOWS

Iowa

113-PROTECTED FLOW PROGRAM
Iowa Natural Resources Council
Instream Flows
Ongoing program implementation; regulation of consumptive uses of streamflow; annual cost $40,000.

WEATHER MODIFICATION

Kansas

114-WEATHER MODIFICATION ACTIVITIES
Kansas Water Resources Board
Weather Modificiation
Ongoing research; comprehensive studies of altering precipitation patterns; grants to public & private agencies; FY 80 cost $197,000; Federal funds $60,000 annually.

North Dakota

115-WEATHER MODIFICATION
North Dakota Weather Modification Board
Weather Modification
Ongoing implementation program of weather modification; total cost FY 79-80 bienium $1.3 million.

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. A relatively large portion of the Missouri Basin is Indian and Federal lands. For the most part, the water rights associated with these lands are not determined. Upon conclusion of the Missouri River Basin Commission's Hydrology Study, the Commission should consider a program directed at developing an administrative framework for resolving those water rights.

B. Each State in the Missouri River Basin has developed a recreational data base through its State Comprehensive Outdoor Recreation Plan (SCORP). For the most part, these data bases are not compatible between States. The Heritage Conservation and Recreation Service should initiate efforts to bring these data bases into a consistent format.

C. State and Federal programs involving flood plain management should consider nonstructural alternatives. Data and information of the Federal Insurance Administration and others should be used in planning to avoid duplication. Further, Federal and State agencies should strive to achieve the goals of the Unified National Program for Flood Plain Management.

CHAPTER 3

UPPER MISSOURI SUBBASIN

SUBBASIN DESCRIPTION

The Upper Missouri Subbasin is a 57.7 million acre area in the northwest part of the Missouri River Basin. As illustrated in figure 6, it includes the land drained by the Missouri River and its tributaries upstream from its confluence with the Yellowstone River at the western edge of North Dakota. The principal tributaries of the Missouri River include the Jefferson, Madison, Gallatin, Sun, Marias, Musselshell, and Milk Rivers. These rivers generally originate in mountainous areas and flow through level to gently rolling plains. Most of the subbbasin lies in Montana with a portion in southern Canada and small areas in North Dakota and Wyoming. The subbasin extends 500 miles east to west, and has a north south extent of 350 miles.

The topography in the subbasin is of two types: a series of intermontane valleys descending from the Rocky Mountains in the west; and a large tableland prairie, broken by deeply entrenched, narrow, meandering streams in the northern and eastern portions. Elevations range from 1,860 feet to 11,293 feet.

Grassland ecosystems are extensive on the plains. There are expansive areas of the mixed grass, short grass, or sagebrush grasslands as well as ribbons of flood plain forests and woodlands along major streams. Ponderosa pine or juniper woodlands are extensive in the upper Fort Peck and Musselshell drainage areas. Areas of croplands, usually under crop fallow systems, are dispersed throughout this subbasin. In the Fort Peck area, there are extensive antelope populations. Populations

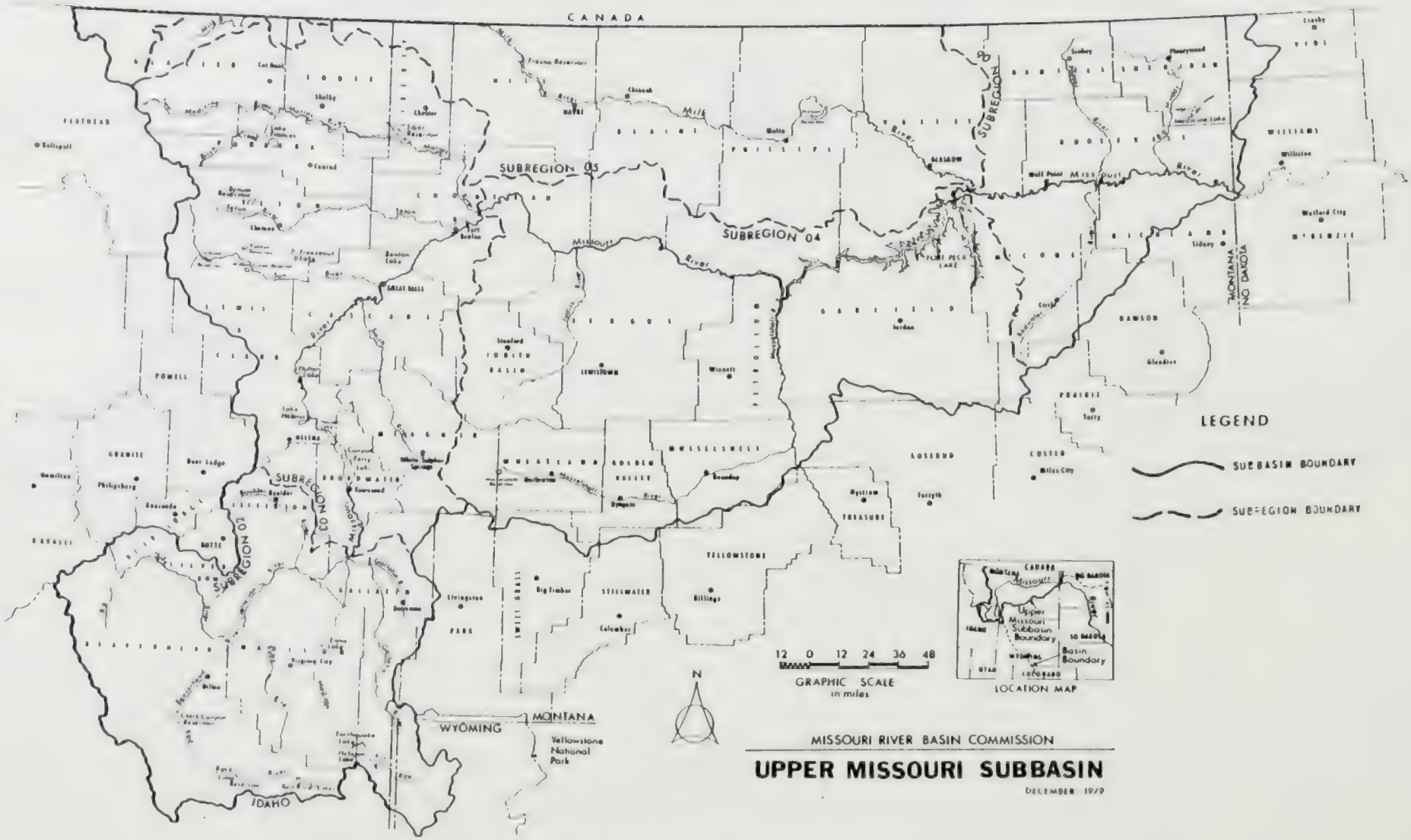


Figure 6 - Upper Missouri Subbasin

of prairie grouse, gray and chukar partridge, Merriam's turkey, and other native prairie species are relatively stable. Mule deer numbers have dropped slightly throughout the plains area, while the populations of bighorn sheep and elk have flourished within the Charles M. Russell National Game Range. The endangered black-footed ferret, American peregrine falcon, and northern swift fox are believed to occur in several different regions of the subbasin.

In the mountain areas, vegetation is more diverse. Grasslands occur in the valleys while forests occur at higher altitudes. Alpine meadows occur at the higher elevations in most mountain ranges. Forests of aspen and lodgepole pine are found over a broad range of altitude but especially on lands having a history of fires or logging. Elk, bighorn sheep, and mountain goat inhabit several mountain areas with black bear, mule deer, and mountain grouse being more widespread. Rare predators include the mountain lion, fisher, pine martin, wolverine, and the Canadian lynx. Croplands found in intermontane areas and valleys are important for wildlife having moderate tolerance to human intrusion, especially deer and various exotics such as ring-necked pheasant and Hungarian partridge.

This subbasin also has a wide diversity of aquatic ecosystems including cold and warm water streams, alpine lakes, prairie-pothole complexes, many reservoirs, and thousands of stock ponds. Fishery resources of reservoirs and warm water streams are generally of good quality. Important species include northern pike, walleye, channel catfish, yellow perch, and several species of centrarchids. Natural wetlands are found across extensive plains areas north of the Missouri River.

The population of the subbasin, estimated in 1975 to be 323,000, is expected to reach 500,000 by the year 2000. In 1975, the people living in urban areas constituted the majority of the population. The Great Falls Standard Metropolitan Statistical Area contained over one-fourth of the subbasin's population. However, the rural population is expected to increase by the year 2000. Presently about 1 out of every 5 persons employed is engaged in agriculture, and by the year 2000 it is estimated that this ratio will decrease to only 1 person out of 10.

Production of small grains and livestock is the predominant source of income in the subbasin. Energy fuels, some mining, tourism and forestry also contribute to the economy. Small manufacturing and the service industry are rapidly growing sectors.

Almost all surface water in this subbasin originates as snow which falls on the Rocky Mountains. This snowmelt accounts for about 20 inches of runoff, while vast areas of the Montana plains contribute less than 1 inch of runoff in an average year. Many uncontrolled stream reaches pass 75 percent of their annual volume during the May and June thaw. This pattern presents problems for instream flow and offstream uses of water.

The subbasin contains the only international waters in the Missouri Basin. The Milk River originates in the United States, flows into Canada, and returns to empty into the Missouri River below Fort Peck Reservoir. An international treaty allows about 136,000 acre-feet of water to be imported from the St. Mary's River into the Milk each year.

In general, ground water is not as important a source of water as surface water in this subbasin. Limited quantities are obtained from small alluvial aquifers near streams. This supply is generally sufficient for domestic use. Extensive alluvial deposits which yield greater quantities of water are found along the Milk River. The most important high yield consolidated rock aquifer is the Madison Limestone where large quantities of water can be obtained especially in the east central part of the subbasin. The quality of the alluvial aquifers generally reflects the water quality of the supplying stream. The greatest contamination is due to salt intrusion from saline seep areas. High concentrations of sodium and chlorides limit use for industry and irrigation in the eastern part of the subbasin.

Instream use of water for the preservation of fish habitat and related recreational flows is important to the character and economy of the subbasin. Montana law permits reservation of water for instream flow purposes.

Maintenance of flows for hydroelectric power generation is another major instream use. Currently installed hydroelectric production capacity is 430 megawatts. Water releases are managed to sustain the highest power output consistent with existing functions. Additional proposed plants may require revising water releases.

The major off stream water use is irrigation. Surface water is used for valley irrigation, which is common throughout the subbasin. Irrigation practices include meadow flooding during

high spring flows and supplemental crop irrigation throughout the growing season. Irrigation water use is projected to increase by the year 2000. In addition, industrial water use for energy is expected to grow significantly. The availability of ground and surface water is judged to be adequate for most consumptive purposes in the future.

The waters in the State of Montana are considered to be public waters. An individual has the right to use water so long as he does not infringe on any rights of prior appropriation. In 1973, the Montana legislature adopted the Montana Water Use Act which established a uniform centralized system for the acquisition, administration, and determination of water rights. The basic concept of the doctrine of prior appropriations has been preserved, that is, the rule of "first in time, first in right." The permit system applies to all types of water appropriation including surface water, ground water reservoirs, and geothermal water. Beneficial use as defined by statute is one of the key criteria to determination of the entitlement of water use. The list of beneficial uses includes water for agricultural (including stockwater), domestic, fish and wildlife, industrial, irrigation, mining, municipal, power, and recreational purposes. The use of surface water for slurry to export coal from the State is currently not allowed in Montana.

PROBLEMS AND OPPORTUNITIES

The major problems in the Upper Missouri Subbasin include rural flooding, water shortages for irrigation, destruction of fishery habitat, upland soil erosion, limited access to water-oriented recreation areas and nonpoint source pollution. Other problems include flooding at a number of locations especially during spring runoff, additional sources of water supply needed for many communities, and developments that impair the natural and aesthetic value of many streams throughout the subbasin.

Rural flooding is common along the Milk, Judith, Musselshell, Sun, Upper Marias and Cut Bank Creek tributaries, and tributaries to the Gallatin, Jefferson, and Madison Rivers. This flooding causes streambank erosion and often adversely affects irrigation pumps, roads, bridges, and fences, and removes land from crop production.

The amount of irrigated acreage is steadily increasing in this subbasin especially along the Milk River. With limited supplies, the competition for water is intense. Many older

surface irrigation systems need rehabilitation to increase efficiency of water use. Water users are often unable to finance the improvements needed. Throughout the subbasin, late season irrigation water shortages are common, especially along the Big Hole, Milk, and Musselshell Rivers.

High quality fisheries along Grasshopper Creek and Wise River are threatened by mine drainage from abandoned copper, lead, gold, and silver mines in the area. Thermal pollution on the Madison River below Ennis Lake has degraded the quality of that river's fishery. Other problems common throughout the subbasin affecting fisheries include irrigation return flows, erosion due to improper land use practices, municipal outflows, and dewatering of many streams. The lake level fluctuations at Fort Peck and Canyon Ferry Reservoirs have affected fish propagation.

Riparian habitat destruction is a major problem on many streams in this subbasin. Reasons for this loss of habitat are crop cultivation near streambanks, livestock pasturing in the riparian zone, and highway and railroad development. While concern for habitat loss has greatly increased recently, no comprehensive inventory has been made to identify specific lands that have been damaged.

Excess water application, improper tillage practices, and overgrazing contribute to wind and water erosion and sedimentation problems. In 10 years up to 15,000,000 acres will be in need of land conservation treatment, due to these factors.

Tourism is a major industry in the subbasin and one which requires sound planning and management. The activities with the greatest need for additional facilities, access, or lands are hunting, developed camping, boating, and swimming. The locations expecting the greatest increase in recreation demand are lands adjacent to Yellowstone Park and the Missouri River segment from Townsend to Cascade, Montana. Natural resources must be protected to ensure continued attraction.

Spring runoff causes urban flooding at many locations. Some of the more severe problems appear at Great Falls on the Sun River, Roundup on the Musselshell River, and Glasgow and Nashua on the Milk River.

There are 10 communities in the subbasin with populations over 3,000, and all will need some type of improvement for water

supply within the next 20 years. In addition, there are 132 communities that currently have or anticipate having problems of water supply or quality before year 2000. The problems these communities face include construction of storage, treatment, and distribution facilities which they cannot afford.

This subbasin has exceptional natural and esthetic resources. Features include wooded river valleys or canyons containing free flowing waters, badlands areas, rugged mountain ranges and forested landscapes, and many historical and cultural sites. A 149 mile reach of the upper Missouri River has been designated as a component of the national wild and scenic river system, and a segment of the Madison River between Earthquake Lake and Ennis has been identified as having outstanding wild and scenic values. Development often conflicts with the natural values of streams, especially streams suggested for designation in the national system of wild and scenic rivers. Water quality degradation, decreased flows, and stream bank structures all contribute to impairment of the natural condition. The potential exists for development of cultural and historical resources at Fort Union National Historic Site along the Lewis and Clark National Historic Trail and on other Indian, national resource, and national forest lands.

Agricultural runoff is the principal nonpoint source pollutant, with contributions from mining and milling generations. Although these have virtually stopped, many years will be required for the streams to completely recover. Point source discharges are expected to remain a minor problem. Most of the municipal discharges are in the process of being corrected.

Most point source discharges are from municipal wastewater treatment facilities, specifically waste water lagoons. While this is an economically suitable treatment method for small Montana communities, a number have developed discharge problems.

Throughout the subbasin there are many Indian and Federal lands with undefined water rights requiring definition in order to plan for effective water management.

The 1973 Montana Water Use Act identified instream flows as a beneficial water use. For this reason, Montana has an opportunity unique among Missouri River Basin States to reserve water for instream purposes. Currently, the Montana Fish, Wildlife and Parks Department is collecting data on several

streams. Eventually these data will be the foundation for instream reservation applications in the subbasin.

National demands for more power may require assessment of new operating criteria and the possibility of installing additional capacity at hydropower dams throughout this subbasin.

PLANNING OBJECTIVES

Montana has a goal to have a comprehensive water resources management plan prepared by 1982. Montana recognizes the need to integrate its planning process with regional planning activities and to insure that its planning proposals provide for the efficient use of water resources while maintaining overall environmental quality.

Montana stresses the need to minimize flood damage, but places the initiative for flood plain regulation at the local level supported by State action.

Montana strongly endorses maintenance and enhancement of fish and wildlife habitat. To this end, the State provides for the reservation of instream flows.

Montana generally supports continued irrigation development where feasible. Montana also emphasizes the need to rehabilitate older systems in order to conserve water.

Protection of the productivity of soils, control of erosion, and reduction of sediment loading in streams and lakes are important objectives in Montana. Incentives are encouraged to implement nonpoint source pollution control programs, including land treatment, bank stabilization, and other management practices.

Hydropower development is encouraged, provided there is State involvement. Montana is concerned about impoundments and their effects on the environment and the possible loss of good croplands. Montana law prevents the use of water for coal slurry pipelines and large water users may not change water use from agricultural to industrial purposes.

PLAN OVERVIEW

The plan for the Upper Missouri Subbasin includes the programs recommended in this chapter and the recommended

basinwide, and statewide progams for Montana and North Dakota in chapter 2. Conclusions and additional recommendations for the subbasin follow the recommended programs in this chapter.

A large number of Soil Conservation Service small watershed programs are recommended in this subbasin, generally to resolve rural flooding problems. Structural flood control alternatives such as dams, levees, and large scale channelization in some instances are not feasible. Nonstructural flood damage reduction measures such as decreasing use of the flood plain for cropland may be needed. Alternatives that might help to minimize the problem are a continuing program of channel clearing and snag removal, and a program to prevent sediment deposition in stream channels; but adequate funding for these programs is not readily available.

Irrigation development can serve a dual role, by both increasing agricultural production and stimulating the subbasin's economy. The importance of irrigation in the area is illustrated by the large number of irrigation programs recommended in the Upper Missouri Subbasin. Among those are programs of the Montana Department of Natural Resources and Conservation to assist in irrigation development in small watersheds and to study the possibility of providing irrigation water storage and instream flows in the Big Hole Basin. The plan contains these Soil Conservation Service watershed projects in the subbasin emphasizing irrigation: the Beaver Creek, Boulder River, and Lower Birch Creek watersheds. Another recommended Soil Conservation Service program involves investigating the feasibility of irrigating additional acreage in the subbasin as well as studying the need to rehabilitate some of the older irrigation systems. A USDA cooperative study being completed on a statewide basis is determining the effects of timber harvest on water yield and sedimentation. The plan also recommends that the Water and Power Resources Service review possible rehabilitation and betterment of two older irrigation systems, Greenfields and West Bench.

A number of recommended multipurpose programs, underway or proposed, address upland soil erosion. Among these are several Bureau of Indian Affairs ongoing programs dealing with land conservation related to Indian reservations. They include the Bureau's Agricultural Resources Program, Forest Management Program, and the Range Stock Water Development Program.

Several programs recommended to control erosion, acid mine drainage, improper grazing and logging, and irrigation return flows are being conducted by the Montana Department of Health and Environmental Sciences through its Pollution Discharge Elimination System Program. Another important recommended program dealing primarily with point source pollution reduction and elimination throughout the subbasin includes the Farmers Home Administration's Water and Waste Disposal Grant and Loan Program.

Recommended efforts in the subbasin directed toward correcting urban flooding problems include the Army Corps of Engineers program to provide a flood control structure on the left bank of the Sun River to protect Great Falls, Montana. Other urban flooding problems remain unaddressed.

Needs for supplies of high quality water for small communities in the subbasin are being addressed by a number of recommended programs. The Water and Power Resources Service through its Water Management Study Upstream of Gavins Point, and the Water Planning Program of the Montana Department of Natural Resources and Conservation are examples. These efforts complement the programs of the Farmers Home Administration referred to above. The National Park Service has an program to correct water supply and quality problems at Glacier National Park.

RECOMMENDED PROGRAMS - UPPER MISSOURI

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-WATER MANAGEMENT STUDY UPSTREAM OF GAVINS POINT DOI/Water and Power Resources Service Comprehensive Also in Yellowstone, W. & E. Dakotas Subbasins	Ongoing special study of water supply and use; scheduled to be completed in FY 81; total cost of $871,000, $136,000 is programmed to be spent in FY 81.
2-SNOW SURVEY USDA Soil Conservation Service Comprehensive Also in Yellowstone & Platte-Niobrara Subbasins	Ongoing data collection of hydrometeorological snow data to provide advance information on seasonal water supplies for regulation and management; FY 81 cost $328,000.
3-HEADWATERS RC&D AREA, MONTANA USDA/Soil Conservation Service Comprehensive	Ongoing special study to provide local groups with assistance in conserving and developing natural resources; part in Pacific NWRB. total cost $822,000.
FLOODING	
4-SUN RIVER, GREAT FALLS, MONTANA Army Corps of Engineers Flooding	Ongoing program implementation of flood control structure on left bank of Sun River that includes a levee and drainage conduit. Total cost $8.5 million, FY 81 cost $2.6 million.
5-FAIRVIEW WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding	Approved flood prevention project scheduled to begin in FY 81; Richland County, MT. and McKenzie County, ND; cost $100,000.

6-FORT BENTON WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding	Approved flood prevention project scheduled for FY 82; Chouteau County, MT; cost $150,000.
7-WOLF CREEK WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding	Approved flood prevention project scheduled to begin in FY 80; Judith Basin, Fergus County, MT; cost $750,000.
8-TEN MILE CREEK WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding	Approved flood prevention project scheduled for FY 81; Lewis & Clark County, MT; cost $1.5 million.
9-BOZEMAN CREEK WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding	Planning underway for flood prevention project scheduled for FY 81; Gallatin County, MT; cost $300,000.
10-CITY OF BROWNING WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding	Under construction flood prevention project scheduled for FY 82 start; Glacier County, MT; cost $1.3 million.
11-BIG SPRING WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding, Rec.	Under construction flood prevention and recreation project; Fergus County, MT; cost $7.8 million.
FISH AND WILDLIFE	
IRRIGATION	
12-UPPER MISSOURI BASIN COOPERATIVE SPECIAL STUDY USDA/Soil Conservation Service Irrigation, Land Cons. & Mgt.	Ongoing special study to determine irrigation potential on projects of 1,000 acres or more scheduled through FY 81; total cost $499,000, FY 81 cost $48,000.

13-REHABILITATION OF EXISTING IRRIGATION SYSTEMS, MT USDA/Soil Conservation Service Irrigation, Land Cons. & Mgt. Also, in Yellowstone and N. Dakotas Subbasins	New start special study to develop inventory of problems and to identify costs and benefits to rehabilitate irrigation systems; FY 81 cost $122,000.
14-BIG HOLE STUDY Montana Dept. of Natural Resources and Conservation Rec., & Instr. Flows	New start special study of reservoir sites off stream for late season irrigation and Irrigation, benefits; total cost $86,500 scheduled through FY 81.
15-GREENFIELDS REHABILITATION AND BETTERMENT PROGRAM DOI/Water and Power Resources Service Irrigation	Ongoing program implementation that includes construction rehabilitation of an existing irrigation system. Total cost $8.3 million scheduled through FY 81.
16-WEST BENCH PROJECT DOI/Water and Power Resources Service Irrigation	Ongoing program implementation that includes construction rehabilitation of an existing 5,700 acre irrigation system; total cost $3.8 million.
17-LOWER BIRCH CREEK WATERSHED, MONTANA USDA/Soil Conservation Service Irrigation	Planning underway for an agricultural water management project for irrigation scheduled for FY 84; Pondera County, MT; total cost $10 million.
18-BEAVER CREEK WATERSHED, MONTANA USDA/Soil Conservation Service Irrigation, Flood, Rec., and F&W	Under construction irrigation, flood prevention, recreation, fish & wildlife project; Hill County, MT; total cost $2.2 million.
19-BOULDER RIVER WATERSHED, MONTANA USDA/Soil Conservation Service Irrigation, Rec., and F&W	Under construction irrigation, recreation, fish & wildlife project; Jefferson County, MT; total cost $11.6 million.

LAND CONSERVATION AND MANAGEMENT

20-AGRICULTURAL RESOURCES PROGRAM, INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Land Conservation & Management, Water Quality Also in Yellowstone Subbasin	Ongoing implementation of program providing water and land resources management assistance; funded through FY 85.
21-FOREST MANAGEMENT, INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Land Conservation & Management,Flood,F&W,Rec.,Water Quality Also in Yellowstone Subbasin	Ongoing implementation of program providing forest management assistance; funded through FY 85.
22-RANGE STOCKWATER DEVELOPMENT ON INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Land Cons. & Mgt.,Flood,F&W,M&I Rural Supply,Water Qual Also in Yellowstone Subbasin	Ongoing implementation of program to construct range water facilities on Indian lands; cost FY 81 $40,000.
23-MONTANA TIMBER WATER FEDERAL-STATE COOPERATIVE SPECIAL STUDY USDA/FS, SCS, ESCS and Montana Dept. of Natural Resources & Conservation Land Conservation & Management, Water Quality Also in Yellowstone & W. Dakotas Subbasins	New start special study with SCS, ESCS, FS, and Montana DNR to determine effects of timber harvest on water yield and sedimentation; cost FY 80 $115,000; FY 81 $120,000; FY 82 $145,000.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

24-GLACIER NATIONAL PARK WATER SUPPLY DOI/National Park Service Municipal, Industrial, and Rural Domestic Water Supply	New start implementation of program to improve the drinking water facilities throughout the park; cost FY 81 $2.5 million.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

25-UPPER MISSOURI RIVER WILD & SCENIC RIVER MGT. PLAN, MT
DOI/Bureau of Land Management
Natural, Historic, & Cultural Resources

Ongoing implementation of program to develop and administer the Upper Missouri River as a part of the wild and scenic river system.
Annual cost $200,000 through FY 85.

26-FORT UNION TRADING POST NAT'L HISTORIC SITE, MT & ND
DOI/National Park Service
Nat Hist & Cult, F&W, Rec, Water Qual, Legal & Inst, Instr Flows

Ongoing program of implementation of a general management plan for a historic site.
Cost FY 81 $50,000, FY 82 $50,000, FY 83 $20,000 FY 84 $264,000, FY 85 $1.1 million.

POWER AND ENERGY

27-FORT BENTON REFORMULATION, MONTANA
DOI/Water and Power Resources Service
Power and Energy, Flood, F&W, Rec.

Resumption of implementation study of a multi-purpose project in North-Central Montana.
Total cost $402,000.

WATER-ASSOCIATED OUTDOOR RECREATION

TRANSPORTATION

WATER QUALITY

LEGAL AND INSTITUTIONAL

INSTREAM FLOWS

28-INSTREAM STUDY FOR THE MISSOURI RIVER WILD & SCENIC CORRIDOR
DOI/Bureau of Land Management
Instream Flows, F&W, Nat. Hist. & Cult.

New start research program to determine flow requirements for fish and other aquatic organisms in part of Missouri River above Ft. Peck Reservoir.
Total cost $150,000, to begin in FY 80.

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. Several problems and opportunities which are not being duly addressed by ongoing or programmed studies by State or Federal agencies have been identified in the Upper Missouri Subbasin. "The Upper Missouri River Basin Level B Study," completed in 1980, addressed these problems.

B. An appraisal level study by the Water and Power Resources Service for installing additional hydroelectric power facilities at Canyon Ferry, Tiber, and Gibson Dams will be updated in FY 1980. It is recommended that the Service conduct feasibility level studies for these projects beginning in FY 1981.

C. The Army Corps of Engineers "Missouri River Review Report" recommended installing additional hydroelectric facilities in this subbasin at Fort Peck Dam. It is recommended that the Army Corps of Engineers receive authorization to proceed with advance planning for these facilities beginning in FY 1981.

D. The State of Montana has applied to the Federal Energy Regulatory Commission for a permit to generate and market hydroelectric power from Broadwater Toston Dam. It is recommended that the permit be granted and construction be pursued to include modification of the existing structure and installation of six tube turbines and associated power facilities. Normal capacity would be 10 megawatts.

E. The State of Montana has submitted a proposal to study irrigation water conservation in Montana. The study being considered by the U.S. Water Resources Council would: (1) assess the water use efficiency of several types of irrigation systems, both public and private, throughout Montana; (2) identify the economic, legal, and institutional factors affecting irrigation water conservation; and (3) recommend an implementable program for enhancing incentives and removing disincentives to irrigation water conservation. It is recommended that this study be funded by the Water Resources Council.

CHAPTER 4

YELLOWSTONE SUBBASIN

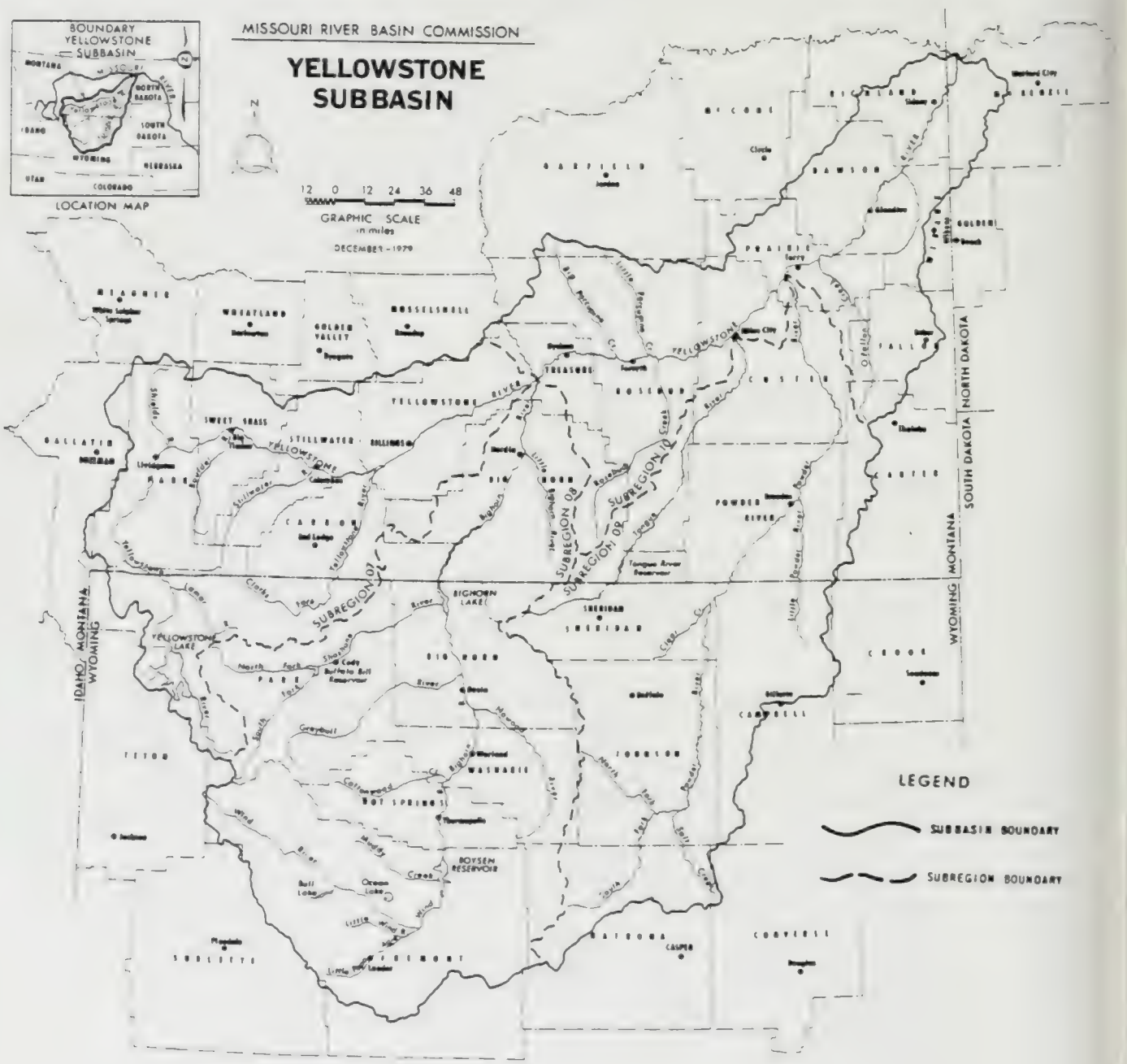
SUBBASIN DESCRIPTION

The Yellowstone Subbasin has an area of 45.2 millon acres and is located in the west central portion of the Missouri River Basin. As illustrated in figure 7, the subbasin includes parts of Wyoming and Montana drained generally from the southwest to the northeast by the Yellowstone River and its tributaries. A small area of North Dakota lies at the mouth of the Yellowstone Subbasin. The subabsin has a maximum extent of 350 miles in an east-west direction and 300 miles north-south.

Topography is essentially of four types. The most extensive is in the eastern portion, a region of plateaus, plains, basins, and isolated mountain ranges with elevations ranging from 5,000 to 8,000 feet. Parts of the western and central portion of the subbasin area characterizes by rugged mountains, broad valleys, and remnants of high plateaus at elevations of 4,000 to 14,000 feet. This region surrounds a highland area of steep slopes with elevations ranging from 2,500 to 6,000 feet. A small area in the extreme northeastern portion of the subbasin is a predominantly smooth plain with elevations ranging from 1,500 to 3,000 feet.

Most ecosystems throughout this subbasin consist of grasslands and deciduous woodlands along streams. Elsewhere, the ecosystems include badlands and agricultural types. The latter occurs as crop-fallow systems on the level uplands or as irrigated lands.

Figure 7-Yellowstone Subbasin



Pronghorn antelope concentrations in the plains areas are unsurpassed in the world. Other significant big game such as elk, mule deer, moose, bighorn sheep, and mountain goat, are also found here. In addition, upland game such as Merriam's turkey, mountain grouse, and prairie grouse are abundant. Several rare animals including the black-footed ferret, Northern Rocky Mountain wolf, grizzly bear, and American peregrine falcon inhabit the subbasin. Other native fauna are the mountain lion, fisher, wolverine, pine marten, Canadian lynx, meadow-jumping mouse, northern swift fox, and certain raptors (prairie falcon, osprey, and burrowing owl). An important upland game bird, the ring-necked pheasant, has been declining for some time due to loss of habitat in agricultural areas.

Abundant cold water fisheries of excellent quality occur in the upper reaches of streams in this subbasin. Other important aquatic resources include the lakes and streams in the Bighorn Mountains and Beartooth Plateau. Some reservoirs afford excellent mixed cold water and warm water fisheries, and in many cases cold water stream fisheries are maintained downstream through the regulated releases of cold waters. High quality waterfowl resources are limited, However, stock pond development on the plains in the past several decades has considerably enhanced the habitat base for waterfowl. Surface water resources are otherwise sparse.

The subbasin has a rich endowment of natural, scenic, historic, and cultural resources. There are pristine and near pristine riverscapes with free flowing waters, high alpine plateaeus punctuated by clear lakes, deep reservoirs, scenic canyons, rugged peaks including snow fields and glaciers, ice caves, multihued deserts and badlands, prairie-butte landscapes, and undulating to rolling plains landscapes featuring ponderosa pine or native grasslands. Sharply contrasting agricutlural patterns of irrigation projects or crop fallow systems further add to visual variety. Significant native American Indian cultural remains and paleontological sites are present as are sites relating to early exploration and settlement.

The population of the subbasin, estimated at 303,200 in 1975, is expected to reach 514,000 by the year 2000. Projections indicate that the Yellowstone may become the Basin's fastest growing subbasins by 1985. The largest concentration of population in 1975 was in the Billings Standard Metropolitan Statistical Area which contained nearly a third of the population of the subbasin. Native American Indian population in the subbasin is estimated at 12,200 persons. By the year 2000, the total is expected to reach 19,000.

Agricultural employment occupies slightly more than 12 percent of all workers in the subbasin. By the year 2000, agriculture will account for about 5 percent of the total employment. One-third of the cropland is irrigated, producing crops including sugar beets, dry, edible beans, hay, and vegetables. Livestock production is the most important agricultural income source.

Increases in national demand for coal and lignite have transformed the subbasin into an important energy development area. Energy product development is expected to dominate manufacturing employment and income subbasinwide by the year 2000.

Tourism is a significant industry in the subbasin and is expected to continue to contribute to the economy.

Streamflows originate primarily from melting snowpacks in the mountains, with high flows in June and July and very low flows in the winter months. Low flows during August reflect both lower natural streamflow and high rates of diversion for irrigation.

About one-third of the major rivers have some form of multipurpose storage. On many tributaries without storage, extensive use of water is made through instream diversions or pumps.

Some 95 percent of water withdrawals in this subbasin is made for crop irrigation. Surface water quality in the mountainous headwaters tends to be good but gradually diminishes as it enters the badlands and plains area. Ground water quality varies in the valley-fill alluvial aquifers along the major streams. Better water quality occurs in permeable zones near areas of natural recharge.

Surface water in each of the three subbasin States is considered public property and is regulated by a State agency. All three States allocate water by the prior appropriation system. Beneficial uses as defined in the three States are listed below. Higher priority uses are cited above those of lower priority under each State, except where noted.

MONTANA

Agricultural (including stockwater)
Domestic
Fish and wildlife
Industrial
Irrigation
Mining
Municipal
Power and recreation

(Note: Uses are not prioritized).

NORTH DAKOTA

Domestic
Municipal
Livestock
Irrigation
Industrial
Fish, wildlife and recreation

WYOMING

Drinking water
Municipal
Steam engines for general railway use; culinary, laundering, bathing, refrigerating, and the manufacture of ice; steam and hot water heating plants; and steam power plants and industrial purposes
Irrigation
Hydropower

PROBLEMS AND OPPORTUNITIES

The major problems in the Yellowstone Subbasin are irrigation water shortages, rural flooding, erosion, and point and nonpoint source pollution. Other problems include urban flooding, municipal water supply shortages, lack of access to outdoor recreation along certain rivers, lack of precipitation, and hail damage.

A common problem along the Powder, Tongue, and Clarks Fork Rivers, and Rosebud Creek, is low flows during the critical crop growing season. In addition, many older irrigation systems need extensive rehabilitation to avoid leakage and to improve efficiency. Irrigation diversion facilities are hampered by low flows, flooding, and erosion on the Bighorn and Yellowstone Rivers.

Rural flooding during the spring is common throughout the Yellowstone Subbasin. The use of and development in areas subject to frequent flooding continues along many streams throughout this subbasin. Some areas lack suitable protection from flooding.

Streambank erosion is a problem along the Yellowstone River and tributaries in Montana, Wyoming, and in McKenzie County, North Dakota. Some farming, forest, and range practices contribute to erosion and sediment problems along the Powder River in Wyoming.

Irrigation return flows have contributed to increasing stream salinity in the Yellowstone River near Billings, Montana, the Shoshone River between Lovell and Kane, Wyoming, and generally along the Wind and Bighorn Rivers in Wyoming. Silt and salinity problems affect seasonal recreation uses of streams in the southern portion of the Powder River Basin. Oil, grease, and coliforms affect Yellowstone River water quality from Laurel to Billings, Montana. Suitable waste-water treatment facilities are lacking at Sheridan, Wyoming.

Spring runoff causes urban flooding at many locations, with some of the more severe problems at Billings and Miles City, Montana, on the Yellowstone River and tributaries.

Additional water supplies are needed to meet urban growth in communities such as Lander, Wyoming, and Billings, Montana. Communities in eastern Montana and in Wyoming need improved water systems due to increased population growth and expansion. Many supplies do not meet acceptable standards for water quality.

Additional public access to streams and hunting grounds is necessary throughout the subbasin to meet recreational demands; notably on the Tongue, Bighorn, and Yellowstone Rivers. In the Miles City area there is a demand for additional flat water or lake recreation.

National demands for more power may require assessment of new operating criteria and the possibility of installing additional capacity at hydropower dams throughout this subbasin. Other energy-related water demands are increasing rapidly. Additional water storage areas are needed along the Tongue and Powder Rivers in Wyoming to meet coal and uranium industry demands.

PLANNING OBJECTIVES

Comprehensive planning goals of the Yellowstone Subbasin States vary considerably. Montana has a goal to have a statewide water resources management plan prepared by the end of 1982. North Dakota is in the process of updating its water resources plan which was initially drafted in 1968. Wyoming's planning process provides for an inventory of water resources, identification of current water use and a projection of future needs. The overall goal is to assess intrastate requirements and compare them with regional and river basin plans, with consideration given to multipurpose projects, and to achieving efficient and beneficial use of the water.

All subbasin States stress the need to minimize flood damage. The States specifically support action at the local level for flood plain management supported where necessary by State action.

The preservation of key natural areas and maintenance of fish and wildlife habitat are goals in all subbasin States. The State of Montana allows for the protection of instream flows for fish and wildlife. North Dakota favors preserving wetland areas through temporary leases and easements rather than by purchase or permanent easements.

It is the objective of all States in the subbasin to develop instate irrigation potential and to provide an adequate supply of water for irrigation. Montana, Wyoming, and North Dakota strongly endorse irrigation water conservation and support rehabilitation and improvement in irrigation systems.

The subbasin States endorse land conservation measures to maintain productivity of soils, to reduce and control erosion, and to reduce sediment. All support State and Federal activities to achieve this goal.

Montana, Wyoming, and North Dakota generally encourage hydropower development. Montana laws prohibit the use of water

for coal slurry pipelines. Large water users in Montana are not permitted to change water use from agricultural to industrial purposes. North Dakota carefully reviews water use for thermal generation plants and has not taken a position on coal slurry pipelines. Wyoming evaluates all proposals before taking any action on coal slurry pipelines.

Use and management of water resources for recreation is endorsed by all States in the subbasin. Each State stresses making these areas accessible for public use.

PLAN OVERVIEW

The plan for the Yellowstone Subbasin includes the recommendations presented in this chapter, and the recommended basinwide and statewide programs for Wyoming, North Dakota, and Montana in chapter 2. The plan for the Yellowstone Subbasin includes the findings of the Yellowstone River Basin and Adjacent Coal Area Level B Study, completed by the Missouri River Basin Commission in 1978.

To address irrigation water shortages, one of the most critical problems in this subbasin, the plan recognizes the importance of completing the Water Management Study Upstream of Gavins Point, now underway by the Water and Power Resources Service. This study will also address a number of municipal water supply and quality problems in the subbasin. In addition, a number of recommended cooperative programs by the Soil Conservation Service address the conservation of irrigation water. Also recommended is continued Bureau of Indian Affairs assistance to the Northern Cheyenne and Wind River Reservations in the developing irrigated lands.

An important ongoing program recommended for completion by the Army Corps of Engineers is examining streambank erosion to determine methods for correcting this problem at three sites along the Yellowstone River. This effort titled "Yellowstone River Bank Protection," is considered a key pilot program for dealing with the streambank erosion problem. A recommended basinwide program, the Rural Clean Water Program, to be administered by the U.S. Department of Agriculture, is expected to be particularly important in the subbasin. When funded, it will help landowners implement conservation practices. With this program, most major erosion and nonpoint source pollution problems will be addressed.

RECOMMENDED PROGRAMS - YELLOWSTONE

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-WATER MANAGEMENT STUDY UPSTREAM OF GAVINS POINT DOI/Water and Power Resources Service Comprehensive Also in Upper Missouri & W. & E. Dakotas Subbasins	Ongoing special study of water supply and land use scheduled to be completed in FY 81; total cost of $871,000; $136,000 is programmed to be spent in FY 81.
2-COMPUTERIZED WATER RESOURCES DATA SYSTEM DOI/Bureau of Land Management Comprehensive	Ongoing data collection and research program to develop a data base for the preparation of management framework plans; annual cost $30,000.
3-BIGHORN BASIN RC&D AREA, WYOMING USDA/Soil Conservation Service Comprehensive	Ongoing implementation of study that assists local areas in conserving & developing natural resources in Bighorn, Hot Springs, Park, Fremont, & Washakie Co.; total cost $550,000.
4-SNOW SURVEYS USDA/Soil Conservation Service Comprehensive Also in Upper Missouri and Platte-Niobrara Subbasins	Ongoing data collection of hydrometeorological snow data to provide advance information on seasonal water supplies for regulation and management of streamflow & storage; FY 81 cost $328,000.
FLOODING	
5-MILES CITY FLOOD CONTROL PROJ., ADV. ENG. & DESIGN, MT Army Corps of Engineers Flooding	Ongoing feasibility study of a 5 mile levee for flood protection for 2,400 families & 300 business; total cost $4.2 million; FY 81 $470,000; FY 82 $3.5 million.

6-BLUE CREEK WATERSHED PROJECT, MONTANA USDA/Soil Conservation Service Flooding	Approved for planning project for flood protection to begin FY 81; total cost $1.5 million.

FISH AND WILDLIFE

IRRIGATION

7-COOPERATIVE IRRIGATION WATER CONSERVATION STUDY, WYOMING USDA/Soil Conservation Service Irrigation Also in Western Dakotas and Platte-Niobrara Subbasins	New start special study of irrigation systems to improve efficiency of distribution and use; total cost $1.1 million programmed through FY 85.
8-REHABILITATION OF EXISTING IRRIGATION SYSTEMS, MT USDA/Soil Conservation Service Irrigation, Land Conservation & Management Also in Upper Missouri & W. Dakotas	New start special study to develop inventory of problems and to identify costs and benefits to rehabilitate irrigation systems; FY 81 cost $122,000.
9-CROW RESERVATION IRRIGATION PROJECT DOI/Bureau of Indian Affairs Irrigation	Ongoing implementation of program to improve agricultural development from FY 79 to FY 85; total cost $15.4 million.
10-NORTH CHEYENNE RESERVATION IRRIGATION PROJECT DOI/Bureau of Indian Affairs Irrigation, Flood, F&W, Land Cons. & Mgmt., Water Qual.	Ongoing implementation of program to improve agricultural development from FY 79 to FY 85; total cost $2 million.
11-WIND RIVER RESERVATION IRRIGATION PROJECT DOI/Bureau of Indian Affairs Irrigation, Flood, F&W, Land Cons. & Mgmt., Water Qual.	Ongoing implementation of program to improve agricultural development from FY 79 to FY 85; total cost $28.1 million.

12-GARLAND DIVISION, REHABILITATION & BETTERMENT PROGRAM, WY DOI/Water and Power Resources Service Irrigation	Ongoing program implementation that includes the rehabilitation of an irrigation system; scheduled for completion in FY 82; Shoshone Project, WY; total cost $6 million.
13-WILLWOOD DIVISION, REHABILITATION & BETTERMENT PROGRAM, WY DOI/Water and Power Resources Service Irrigation	New start program implementation that includes the rehabilitation of an existing system; scheduled through FY 81; Shoshone Project, WY; total cost $1.6 million.
14-FRANNIE DIVISION, REHABILITATION & BETTERMENT PROGRAM, WY DOI/Water and Power Resources Service Irrigation	Ongoing special study to determine feasibility of a program to improve an irrigation system; FY 80 funding involves general investigation; FY 81 cost $200,000; Shoshone Project, WY.
15-LOWER YELLOWSTONE, REHABILITATION & BETTERMENT PROGRAM, MT DOI/Water and Power Resources Service Irrigation	New start program implementation that includes the rehabilitation of an existing system; scheduled through FY 81; Lower Yellowstone Project; total cost $12.6 million.
16-HUNTLEY REHABILITATION & BETTERMENT PROGRAM, MT DOI/Water and Power Resources Service Irrigation	New start program implementation that includes the rehabilitation of an existing system; construction start scheduled for FY 80; Huntley Project; total cost $7.8 million.
17-COONEY DAM REHABILITATION, MONTANA DOI/Water and Power Resources Service Irrigation	New start program implementation to improve and enlarge dam for additional water storage for irrigation; total cost $1 million.
18-UPPER SHELL CREEK WATERSHED PROJECT, WYOMING USDA/Soil Conservation Service Irrigation, Land Conservation and Management	Planning authorization requested for irrigation, recreation, and M&I water that includes 1 multipurpose structure and land treatment, to be planned with Lower Shell project.

19-LOWER SHELL CREEK WATERSHED PROJECT, WYOMING USDA/Soil Conservation Service Irrigation, Land Conservation and Management	Planning authorization requested for irrigation, recreation, and M&I water, includes 1 multipurpose structure, canal rehabilitation, and land treatment; total cost $2 million..
20-PRAIRIE DOG WATERSHED PROJECT, WYOMING USDA/Soil Conservation Service Irrigation, Land Conservation and Management	Project recommended for planning to control erosion caused by diversion of irrigation water; facilities include pipeline & land treatment; total cost $1 million

LAND CONSERVATION AND MANAGEMENT

21-YELLOWSTONE RIVER BANK PROTECTION (Sec 32), MT Army Corps of Engineers Land Conservation and Management	Ongoing implementation of program to demonstrate streambank erosion control at sites in Montana & North Dakota; funding on annual basis; FY 80 cost $450,000.
22-AGRICULTURAL RESOURCES PROGRAM, INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Land Conservation and Management, Water Quality Also in Upper Missouri Subbasin	Ongoing implementation of program providing water and land resources management assistance; funded through FY 85.
23-FOREST MANAGEMENT, INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Land Cons. & Mgmt., Flood, F&W, M&I, Rec., Water Qual. Also in Upper Missouri Subbasin	Ongoing implementation of program providing forest management assistance; funded through FY 85.
24-RANGE STOCK WATER DEVELOPMENT ON INDIAN RESERVATIONS DOI/Bureau of Indian Affairs Land Cons. & Mgmt., Flood, F&W, M&I Rural Supply, Wtr Qual Also in Upper Missouri Subbasin	Ongoing implementation of program to construct range water facilities on Indian lands; cost FY 81 $40,000.
25-MONTANA TIMBER WATER FEDERAL-STATE COOPERATIVE SPECIAL STUDY USDA/Forest Service; USDA/Soil Conservation Service Montana Dept. of Natural Resources and Conservation Land Conservation and Management and Water Quality Also in Upper Missouri & W. Dakotas Subbasins	New start special study with SCS, ESCS, FS, and Montana DNR to determine effects of timber harvest on water yield and sedimentation; cost FY 80 $115,000; FY 81 $120,000; FY 82 $145,000.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

26-YELLOWSTONE NATIONAL PARK, WYO., MONT., & IDAHO DOI/National Park Service M&I and Rural Supply, Nat., Hist., & Cult., Water Qual.	Ongoing program implementation to construct an improved water system throughout the park; cost FY 81 $5.5 million.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

27-BIGHORN CANYON NATIONAL RECREATION AREA DOI/National Park Service Nat. Hist. & Cult., F&W, Land Cons. & Mgt., Rec., Trans., Water Qual.	Ongoing program implementation to prepare a detailed environmental statement on a general management plan; cost through FY 83 $202,000.

POWER AND ENERGY

28-OFFSTREAM STORAGE, YELLOWSTONE RIVER DOI/Water and Power Resources Service Power and Energy, Irrigation, M&I Rural Supply	New start special study to determine needs for energy, irrigation, municipal, & recreation, from Buffalo Creek, Cedar Ridge, & Sunny Creek storages; total cost $350,000, FY 81 start.
29-GARLAND CANAL POWER PROJECT, WYOMING DOI/Water and Power Resources Service Power and Energy, Irrigation	New start program implementation to construct a 2,400 KW powerplant with a parallel penstock; near Corbett Dam on Shoshone River; 10,000,000 KWH will be generated annually; total cost $2.6 million.

WATER-ASSOCIATED OUTDOOR RECREATION

30-PORCUPINE CREEK SCENIC AND RECREATIONAL RIVER, WY DOI/Bureau of Land Management & USDA/Forest Service Recreation & Legal & Institutional Factors	New start special study to consider management of stream as scenic and recreational river; total cost $274,000.

TRANSPORTATION

WATER QUALITY

LEGAL AND INSTITUTIONAL FACTORS

31-YELLOWSTONE RIVER BASIN, INDIAN RESERVATION WATER RIGHTS DOI/Bureau of Indian Affairs Legal and Institutional Factors	Ongoing data collection program to plan the use and development of reservation lands as provided by law, treaty, or other means; total cost $1.5 million.

INSTREAM FLOWS

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. Municipal water supplies for Lander and Basin, Wyoming, are periodically inadequate to meet current and projected near-term future water demands. No programs are underway to consider alternative water supply approaches for these communities. The State of Wyoming, in cooperation with involved Federal agencies, should study water supply options for these and other cities in the subbasin impacted by rapid energy development.

B. An appraisal level study by the Water and Power Resources Service for additional hydroelectric power facilities at Yellowtail Afterbay Dam will be complete in FY 1980. It is recommended that the Service conduct a feasibility level study for this project beginning in FY 1981.

C. Hail storms annually destroy large amounts of grain and feed crops in the Yellowstone Subbasin. Federal agencies with authority or capability in weather modification, in cooperation with the States of Montana and Wyoming, should assess the potential for hail suppression in this subbasin.

D. The Missouri River Basin Commission completed the Yellowstone River Basin and Adjacent Coal Area Level B Study in November 1978. This study provided much information relevant to water resources planning and management and energy development in the Yellowstone Subbasin. To date, few of the study's findings and recommendations have been integrated into State water or energy plans in either Montana or Wyoming. Recommendations from the Yellowstone Level B Study include modifications or additions to Federal laws, policies, or priorities, and State laws and policies. These recommended revisions and changes (summarized below) are intended to suggest courses of action which will facilitate coordination of water resource management.

The recommended revisions in Federal laws, policies, and priorities in Montana include:

Quantification of Indian reserved water rights
Adoption of a national energy conservation program
Development of a renewable energy resources program
Auditing of strip mine reclamation research
Exchanges of mineral ownership

Evaluate streambank erosion
Development of Broadview-Wheat Basin Waterfowl refuges
Assurance of Federal water planning agencies participation in level B or similar planning efforts

Recommended legal and institutional changes for the State of Montana include:

Selection and evaluation of off-stream storage sites
Planning for rural domestic water use in eastern Montana
Reconsideration of present constraint on slurry lines as nonbeneficial use of water
Continuation of free-flowing Yellowstone River
Classification of streams according to fish and wildlife and esthetic value or potential
Identification and protection of archaeological and historical sites

Suggested revisions in Federal laws, policies, and priorities in Wyoming include:

Additional funding for land conservation measures
Adequate funding for land conservation and livestock water improvements on public lands
Joint survey and study of unique areas
Uniform methodology for inventory of recreation resources and capabilities
Amendment of section 7 of the Federal Water Project Recreation Act (79 Stat 213) to encourage greater recreation development at water projects
Improvement of systems for collection of basic data on nonpoint source pollution
Increased funding for wastewater construction grants
Accelerated acquisition of environmental base data
Development of environmental projections using various assumptions about economic conditions

Recommended legal and institutional changes in the State of Wyoming include:

Rehabilitation of canals through State aid
Increased efficiency of irrigation water use
Provision for offsetting social losses resulting from conversion of rangeland to cropland
Provision of minimum practicable daily and seasonal fluctuation in reservoirs

Authorization of State Engineer to license well drillers
Contract for surplus water available in existing Federal Reservoirs
Analysis of adequacy of all municipal water supplies and development of plans
Analysis, with State of South Dakota, of potential use of Keyhole Reservoir
Amendment of Wyoming Industrial Plant Siting Act to give consideration to water resource relationships
Resolution of article X, Yellowstone Compact, dealing with water transfers out of Yellowstone Basin
Establishment of utility corridors to minimize developmental impact on land
Intensified research for rehabilitation of strip mined lands
Establishment of air-monitoring network
Development and implementation of a plan to reduce energy use
Initiation of land use planning
Requirement of permits for stream channel modification
Identification and publicizing of potential flood hazard areas
Provision for instream flow as a beneficial use
Identification and preservation of critical aquatic and wildlife habitats
Establishment of a stream classification system
Designation of Wind River Canyon as a unique archaeologic area
Provision for full disclosure of environmental impacts of actions for other than federally funded developments

E. The Yellowstone Level B Study recommended that the Army Corps of Engineers address flooding problems at Sheridan, Wyoming. The recommendation calls for construction in the near-term future of 2.4 miles of intermittent levees and channel improvements along Goose Creek.

F. Irrigation development can serve the dual role of raising and stabilizing crop productivity and providing an economic stimulus to agriculture throughout the Yellowstone Subbasin. The Yellowstone Level B Study proposed a number of irrigation projects to be undertaken by the Water and Power Resources Service, the Soil Conservation Service, the

Montana Department of Natural Resources and Conservation, and the Wyoming Water Development Commission. Recommendations of the Yellowstone Level B Study are part of this regional plan update, although some of the proposals for irrigation extend beyond the time period of this update. A listing of the programs recommended (by lead agency) is given below:

Water and Power Resources Service

White Horse Bench Unit, appraisal study
Huntley South Unit, appraisal study
Clarks Fork Offstream Storage, appraisal study
Greybull Flat Unit, appraisal study
Badger Basin, appraisal study
Seven Mile-Sitting Bull Unit, feasibility study
Conn's Coulee, feasibility study
Fox Creek South Unit, feasibility study
Seven Sisters Unit, feasibility study
Hardin Unit, feasibility study
Muddy Ridge Area, authorization for construction
Polecat Bench, authorization for construction

Soil Conservation Service

Hidden Valley Project
Taylor Dutch Flats Project
Cody Canal Rehabilitation
Lateral H-103 Improvement
Crow Creek Project
Middle Fork Crazy Woman Project
Flathead Creek Project
Pryor Creek Project
Wyola-Lodge Grass Canal
Long Otter and Gas Field Pumping Unit
Upper Beaver Creek
Nowood River Project
Cyclone Bar Project
Crooked Creek Project
Gooseberry Creek Project
Lower Greybull River Project
Lakeview Canal Rehabilitation
Sage Creek-Pryor Mountain
Sidon Canal Rehabilitation
South Tongue Watershed

Montana Department of Natural Resources and Conservation

Hay Creek Unit
Forsyth Unit
Fallon Bench
Broadview Bench Unit
War Dance Unit

Wyoming Water Development Commission

Sand Mesa Project
Kirby Draw Project
Banjo Flats Project
Shoshone Extension Unit
McCollough Section
Sage Section
Westside Irrigation Project
Kaycee Project

G. Accelerated land treatment on public and private lands was recommended throughout the subbasin by the Yellowstone Level B Study, to be carried out by the Soil Conservation Service, the Forest Service, and the Bureau of Land Management. The planning areas and acreages, which may be modified through further planning, include:

Upper Yellowstone--431,000 acres of State and private lands, 13,500 acres of public lands, and 2,400 acres of National Forest System Lands.

Lower Yellowstone--1,551,000 acres of State and private lands, 251,000 acres of public lands, and 700 acres of National Forest System Lands.

Clarks Fork-Bighorn--385,000 acres of State and private lands, and 25,500 acres of public lands.

Tongue and Powder--639,000 acres of State and private lands, 78,000 acres of public lands, and 4,300 acres of National Forest System Lands.

Wind-Bighorn-Clarks Fork--1,432,000 acres of State and private lands, 556,000 acres of public lands, and 5,540 acres of National Forest System Lands.

Northeast Wyoming--5,472,000 acres of State and private lands, 217,000 acres of public lands, and 110,100 acres of National Forest System Lands.

Another land treatment measure recommended is a Soil Conservation Service program, Rehabilitation of the Headwater Basin of the Shields River to alleviate the severe sedimentation problem. To the extent that further planning determines forest lands are involved, the Forest Service will participate in land treatment. The Yellowstone Study further recommended that controls be established limiting commercial development in the Sunlight-Crandall Basin of the Wind-Bighorn-Clarks Fork planning area; these controls would be implemented by the Forest Service to preserve scenic values. Another recommendation, Streambank Greenbelt Program to be carried out on streams throughout the Montana portion of the Yellowstone subbasin by the Montana Department of Natural Resources and Conservation, is intended to prevent erosion along streambanks while adding to fish and wildlife habitat. All of these Yellowstone Level B Study programs are recommended in the regional plan. Controls in the Sunlight-Crandall Basin will be further explored in current planning for the Shoshone National Forest Land and Resource Management Plan; any controls relating to private lands would be instituted and implemented by State or local authorities.

H. Several programs recommended in the Yellowstone Level B Study to address water supply needs have been adopted as part of this regional plan update. Two Soil Conservation Service programs, the Elbow Creek Project and the Blue Water-Five Mile Creek Project, were proposed to provide water supply and other needs in Carbon County, Montana. The Forest Service will consider alternate multipurpose reservoir sites on the South Tongue River (Shutts Flats) in the process of preparing the Land and Resource Management Plan for the Bighorn National Forest. The recommended Northeast Wyoming Project to be implemented by the Wyoming Water Development Commission serves several purposes, providing a water supply system for agriculture, industry, recreation, and fish and wildlife habitat. Also, the Buffalo Bill Reservoir Enlargement to be undertaken by Water and Power Resources Service should be authorized for construction.

I. The Yellowstone Level B Study recommended that several natural and scenic areas be preserved throughout the

Yellowstone Basin. The agencies selected to implement or consider actions in their respective areas are listed below. Actions taken since the completion of the level B study are also shown.

Forest Service

Beartooth and Absaroka Primitive Area; classify as a wilderness area in order to maintain the area in a natural state. Montana portions of this area were classified as wilderness in 1978. Management direction for the Wyoming portion will be considered in preparation of the Shoshone National Forest Land and Resource Management Plan.

Clarks Fork River, section from Wyoming border area to Crandall Creek Bridge, 20 river miles; designate as national recreation river. Management direction for this river reach will be considered in preparation of the Shoshone National Forest Land and Resource Management Plan.

Clarks Fork River, section from Crandall Creek Bridge to mouth of Clarks Fork Canyon, 22 miles; designate as national wild and scenic river. The Forest Service has nearly completed the study report as directed by Congress.

High Country Lakes; this would be an extension of the area in Montana to be considered as a wilderness area; all land in Shoshone National Forest. Management direction for this area will be considered in preparation of the Shoshone National Forest Land and Management Plan.

Cloud Peak Primitive Area; classify as wilderness area. The Forest Service has completed the study for this area.

Heritage Conservation and Recreation Service

Yellowstone River; establish National wild and scenic river designation for 225 river miles from Gardiner to Pompey's Pillar.

Boulder River; establish State recreational designations for 58 river miles, from Upside-Down Creek to confluence with Yellowstone River.

Shields River; establish State recreational river designation for 40 river miles from Flathead Creek to confluence with the Yellowstone River.

Stillwater River; establish State recreational river designation for 65 river miles from 20 miles above the U.S. Forest Service Woodbine Campground to confluence with the Yellowstone River.

Yellowstone River; establish National, scenic, and recreational designation for the Lower Yellowstone River for 260 river miles from Pompey's Pillar to the Montana-North Dakota border.

Bighorn River; establish State recreational river designation for the Bighorn River below Bighorn National Recreation Area to Yellowstone River for 50 river miles.

Clarks Fork River; establish State recreational river designation for 75 river miles from the Montana border to Yellowstone River.

Wind River; National designation as a wild, scenic or recreational river from source to Boysen Reservoir.

Montana Department of Fish, Wildlife and Parks

Clarks Fork River, section from mouth of Clarks Fork Canyon to Montana State line, 20 miles; maintain as State recreation river.

All of these programs are recommended in the regional plan update.

J. A number of programs were recommended in the Yellowstone Level B Study to meet rising energy requirements. These recommendations are included in the regional plan update. A project that will add to energy production in this subbasin is the Tongue River Reservoir Modifications to be undertaken by the Montana Department of Natural Resources and Conservation.

K. The Yellowstone Level B Study recommended programs to meet recreation demands throughout the subbasin. These programs are included in the regional plan and are summarized below under the lead agency.

Forest Service

Popo Agie River; 29 miles of North, Middle, and Little Popo Agie above the National forest boundary, designate as national scenic and recreational rivers.

North Fork Shoshone River; section from the north Absaroka Wilderness boundary to the eastern National forest boundary, 20 miles, designate as a scenic and recreational river.

Shell Creek; from source to the Bighorn National Forest boundary, 26 miles, designate as a national scenic or recreational river.

Tensleep Creek; section from Tensleep Lake to Tensleep, Wyoming, 23 miles, designate as a scenic and recreational river.

Tongue River; from source to the National forest boundary, 26 miles, designate as a scenic or recreational river.

South Tongue River Recreation; from source to Tongue River excluding a small reservoir above Shutts Falls, 27 miles, designate as a scenic or recreational river.

These recommendations are being considered by the Forest Service in the preparation of the Shoshone and Bighorn National Forest Land and Resource Management Plans.

Heritage Conservation and Recreation Service

Bighorn River; National designation of section from Boysen Dam to north end of Wind River Canyon for 12 miles, as wild, scenic, or recreational river; designate sections for 98 miles from Bighorn River at the north end of the Wind River Canyon to Bighorn Lake as a State scenic or recreational river.

Wyoming Recreation Commission

North Fork Shoshone River; designate ten mile section from National forest boundary to Buffalo Bill Reservoir as a recreation river to be preserved and managed by the State of Wyoming.

Tongue River; designate 35 miles from the National forest boundary to the Montana-Wyoming border as a recreational river to be preserved and managed by the State of Wyoming.

L. Minimum flow levels to conserve fish and wildlife in streams throughout the subbasin were recommended in the Yellowstone Level B Study. These recommendations should be implemented by the Fish and Wildlife Service and the State of Wyoming Game and Fish Department and the Montana Department of Fish, Wildlife and Parks.

CHAPTER 5

WESTERN DAKOTAS SUBBASIN

SUBBASIN DESCRIPTION

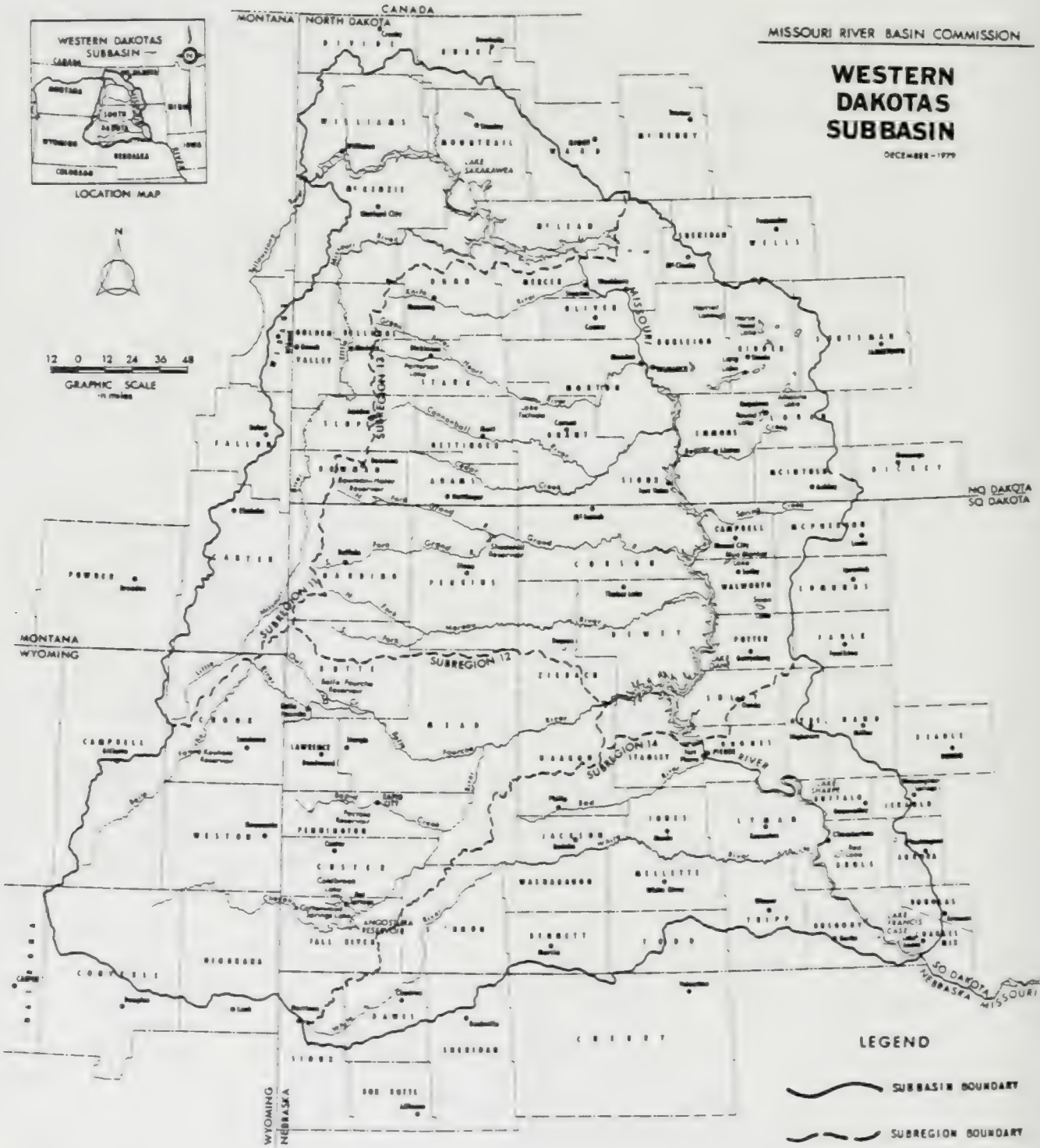
The Western Dakotas Subbasin, an area of 64.9 million acres, is geographically the largest subbasin in the Missouri River Basin. As illustrated in figure 8, it includes those parts of Montana, Wyoming, North Dakota, South Dakota and Nebraska drained by the Missouri River from the mouth of the Yellowstone River near the Montana-North Dakota border, downstream to the Fort Randall Dam near the Nebraska-South Dakota border. The main tributaries to the river include the Little Missouri, Cannonball, Grand, Moreau, Cheyenne, Bad, and White Rivers. The subbasin has maximum north-south and east-west extents of over 400 miles.

A rolling topography with wide expanses of level tablelands and accompanying deep stream trenches characterize this subbasin. Elevations average 2,000 feet. Two unique topographic areas are found in this subbasin: the Black Hills of the west, an isolated mountainous region; and the Missouri Coteau, a plateau-like highland lying east of the Missouri River.

Prairie grassland ecosystems provide antelope and mule deer habitat and support sharp-tailed grouse. Prairie dog towns are scattered widely in these areas and sightings of the rare black-footed ferret have been documented. The northern swift fox and a near pristine assemblage of prairie species also are found here.

Flood plain woodlands occur along major streams. Pine forests occur throughout southeast Montana, northeast Wyoming, western South Dakota, and northwest Nebraska. Both of these provide habitat for important animal groups.

Figure 8- Western Dakotas Subbasin



In North Dakota, cropland ecosystems have developed in areas of suitable soil and topography. Comparatively, less cropland development has occurred elsewhere in this subbasin. In areas with favorable interspersion of habitat, huntable populations of ring-necked pheasant, Hungarian partridge, and other upland game occur.

Aquatic resources are limited in most of the subbasin. Cold water lakes, streams, and reservoirs are confined to the Black Hills area. Warm water fisheries include only a few reaches and reservoirs along tributaries. Sport fisheries at some reservoirs have declined due to unsuitable spawning habitat. Waterfowl populations are significant in the Missouri Coteau region of North and South Dakota and along the Missouri River and its reservoirs.

Natural and scenic resources include the Black Hills, the Badlands of North and South Dakota, the Pine Ridge Escarpment, the Buffalo Gap, Little Missouri and Fort Pierre National Grasslands, and a number of free-flowing rivers with wooded or grass valleys. Other landscapes such as the prairie-pothole, prairie-reservoir, prairie-butte, and ponderosa pine stands also add to the visual diversity.

Cultural and geological resources include paleontological sites, Indian villages, and historic sites which reflect settlement and exploration. The Knife River Indian Village National Historic Site and the Lewis and Clark National Historic Trail will integrate several natural, historic, and cultural areas along the Missouri River.

The population of the subbasin, estimated at 410,700 in 1975, is expected to reach 464,100 by the year 2000 with the majority of the population remaining rural. In addition, the subbasin is now, and is expected to remain, the least populous in the Missouri River Basin. The American Indian population is the largest of any of the subbasins in the basin numbering about 35,000 or 8.5 percent of the total population.

Twenty-two percent of all subbasin workers are currently employed in agriculture. This figure is expected to decline to 16 percent by the year 2000. The total work force, currently 158,000, is expected to increase by 16,800 workers by the year 2000 some of which will be caused by energy developments in the

subbasin. Livestock continues to dominate agricultural production, with one out of every four agricultural workers directly engaged in ranching. Dryland crops include wheat, corn and hay, with irrigated acreage producing alfalfa, corn, dry beans, and sugar beets.

Energy fuels production is of increasing importance to the subbasin economy. Coal and lignite deposits are significant as are crude oil and natural gas. Gold mined in the Black Hills accounted for 31 percent of the nation's production in 1974.

Manufacturing is centered in urban areas such as Rapid City, South Dakota and Bismarck, North Dakota although small manufacturing firms mainly agri-related are found throughout the subbasin. Important tourist centers include the Black Hills, Badlands, and the large reservoirs on the Missouri River.

Water supplies are limited in this subbasin except in the Missouri River and its reservoirs. Surface water is generally intermittent during the year except where flows are regulated in some streams in the Black Hills, and the Missouri River. Many other streams have high concentrations of sediment and minerals producing very poor water quality. Ground water quality is generally poor throughout the subbasin. Irrigation accounts for most of the water use.

All surface waters in all five States are legally considered public property and are allocated only for beneficial uses by each State regulatory agency. All five States allocate by prior appropriation. Beneficial water uses as defined in each State are listed below. Those uses with higher priority are listed above uses with lower priority under each State heading, except as noted.

NORTH DAKOTA

Domestic
Municipal
Livestock
Irrigation
Industrial
Fish, wildlife, and recreation

SOUTH DAKOTA

Domestic

Other uses such as municipal, industrial, irrigation, water quality management, fish, wildlife, and recreation receive equal consideration

WYOMING

Drinking water
Municipal
Steam engines and general railway use; culinary, laundering, bathing, refrigerating; and the manufacture of ice; steam and hot water heating plants; and steam-power plants and industrial purposes
Irrigation
Hydropower

NEBRASKA

Domestic
Irrigation
Power and manufacturing

MONTANA

Agricultural (including stockwater)
Domestic
Fish and Wildlife
Industrial
Irrigation
Mining
Municipal
Power and recreational uses
(Note: uses are not prioritized).

PROBLEMS AND OPPORTUNITIES

The major problems in the Western Dakotas Subbasin are the limited availability of good quality drinking water, irrigation water shortages, erosion, point and nonpoint source pollution, and urban and rural flooding. Other problems include fishery habitat destruction, limited access to and lack of water-oriented outdoor recreation facilities, and the dewatering of streams.

In general, the Western Dakotas Subbasin does not have water supplies of quality suitable for most uses. Recent surveys in the South Dakota portion of the subbasin indicate that there are

nine communities with water supply problems. A similiar survey by North Dakota indicates that there are 22 communities with water supply problems, 10 of which have severe problems. All these communities have expressed an interest in obtaining a new or supplemental water supply. The Cheyenne River Basin, extending from east central Wyoming to southwestern South Dakota, has the most severe problems involving water quality and supply.

In general, ground water quality for rural domestic uses does not meet drinking water standards. The quantity of water for rural domestic supply is insufficient in the Bad River Basin. The South Dakota counties of Ziebach, Perkins, and Dewey and the Cheyenne Indian Reservation have poor water quality and insufficient water quantity for domestic, livestock and other agricultural purposes.

Irrigation water shortages occur annually throughout the subbasin. Areas of severe shortages are Perkins and Corson Counties, South Dakota, and along the Grand River. The Belle Fourche irrigation project is in need of rehabilitation. Lands that could be served by diversions from the Belle Fourche River are located along and below the project.

All streams in this subbasin, except the Missouri main stem, annually experience water shortages. This is especially true after mid-July, and causes a deterioration in water quality.

Bank erosion along the Missouri River between Garrison Dam and Lake Oahe causes the loss of agricultural lands, degrades water quality, and threatens residences. Elsewhere, severe erosion of agricultural lands occurs in many tributaries, especially the White and Bad Rivers. Upland erosion problems are especially significant on the lands near the Little Missouri, Grand, Moreau, Cheyenne, Bad, and White Rivers. Sedimentation is a problem in most lakes in the Black Hills and at the headwaters of Lake Oahe and Lake Sakakawea. Higher river levels caused by river bed aggradation are contributing to high ground water and salinity in the headwater areas of the main stem reservoirs.

The Heart and Little Missouri Rivers have high concentrations of nitrates, phosphates, TDS, and coliforms. Coliform bacteria often indicate the occurrence of point source pollution from feedlots. However, cattle grazing over large areas may also contribute to this problem. Increases in energy-related activity are adding to the waste load carried by the Knife River and tributaries. It is expected that increased strip

mining and oil drilling activities could affect both ground water and surface water adversely over large segments of the Missouri River Basin.

Spring runoff causes urban flooding at many locations. The most severe problems occur in South Dakota along Hay Creek and Redwater River at Belle Fourche, along the Bad River at Ft. Pierre; and in North Dakota along the Cannonball River at Mott, Little Missouri River at Medora, Antelope Creek at Hazen, Heart River at Belfield, and Apple Creek south of Bismarck.

There is an opportunity to expand hydroelectric power production by adding additional units to existing main stem dams and placing some pump-back storage hydropower units along the Missouri River and main stem reservoirs. Other opportunities exist for energy, industrial, and agricultural development, if a large quantity of good quality Missouri River water was available where it could be utilized.

PLANNING OBJECTIVES

The States in the Western Dakotas Subbasin actively support the concept of State and regional planning. Approaches vary from State to State, but generally focus on the objective of giving full consideration to all water resources functions in the formulation of State policies toward water resources management.

It is the objective of all five States to develop irrigation to its potential and to provide adequate water supplies accordingly. Montana, North Dakota, and South Dakota strongly endorse irrigation water conservation and support rehabilitation and improvement of existing systems.

Another common objective is to meet municipal, industrial, domestic, and livestock water supply and quality needs wherever feasible. Wyoming emphasizes water storage while also stressing water conservation measures.

PLAN OVERVIEW

The plan for the Western Dakotas Subbasin includes the recommendations presented in this chapter, and the recommended basinwide and statewide programs for South Dakota, North Dakota, Montana, Wyoming, and Nebraska in chapter 2.

Since water quality and quantity problems affect most of the residents of this subbasin, a number of programs are included in the plan to address them. A Corps of Engineers study of the Western Dakotas Region of South Dakota, is designed to examine all drinking water problems in western South Dakota. When completed in FY 1983, this study should present alternatives and recommended approaches for satisfying many water supply needs for this area. The Water and Power Resources Service's Water Management Study Upstream of Gavins Point, recommended program No. 1, also has as one of its objectives satisfying water supply needs for municipal and rural domestic users. Another important recommended program is South Dakota's Department of Water and Natural Resources West River Aqueduct Study, which involves the investigation of the feasibility of supplying water by pipeline to western South Dakota and possibly to eastern Wyoming. Two recommended programs in North Dakota, the Minot Extension Reformulation, and Versippi Unit Feasibility Study, are structured to provide needed water supplies respectively for Minot and Dickinson, North Dakota. The Farmers Home Administration's program to assist development of rural water systems basinwide is also a key program in this subbasin. Several rural water organizations have been and are being formed to actively promote and facilitate construction of water supply systems.

The availability of water for irrigation is being addressed by a number of programs including the Water Management Study Upstream of Gavins Point by the Water and Power Resources Service. Other important recommended irrigation programs include the Grass Rope Unit in South Dakota, Apple Creek Unit in North Dakota, the Apple Creek Unit Ground Water Studies in North Dakota, the Pollock-Herreid Unit in South Dakota, Lower Brule Indian Reservation Area in South Dakota, Oahe Riverside Irrigation Study in South Dakota, Lower James-Fort Randall Water Diversion Proposal Study in South Dakota, and Reevaluation of the Pine Ridge Irrigation Unit in South Dakota. Conservation of irrigation water is stressed in two Soil Conservation Service programs, a Cooperative Irrigation Water Conservation Study in Wyoming, and Rehabilitation of Existing Irrigation Systems Cooperative Special Studies in Montana. An important program recommended to address bank erosion along the Missouri River main stem is the ongoing Corps of Engineers Missouri River Bank Stabilization Demonstration Project, which is investigating erosion control at a number of sites along the Missouri River. The recommended basinwide Rural Clean Water Program, to be administered by the U.S. Department of Agriculture, will be an integral program in this subbasin. When the program is funded,

it will help landowners implement land conservation practices and address most major types of erosion and nonpoint source pollution problems. In general, rural flooding problems in this subbasin remain unaddressed. Only three small watershed projects are recommended. Most structural flood control alteratives such as dams, levees, and large scale channelization are not economically feasible. Nonstructural flood damage reduction measures may be needed. A continuing program of channel clearing and snag removal, and a program to prevent sediment deposition in stream channels could possibly minimize the problems. However, adequate funding for such programs is not readily available.

RECOMMENDED PROGRAMS - WESTERN DAKOTAS

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-WATER MANAGEMENT STUDY UPSTREAM OF GAVINS POINT DOI/Water and Power Resources Service Comprehensive Also in Upper Missouri, Yellowstone & E. Dakotas Subbasins	Ongoing special study of water supply and use scheduled to be completed in FY 81; at a total cost of $871,000, $136,000 of which is programmed to be spent in FY 81.
2-WILLISTON BASIN RC&D AREA, NORTH DAKOTA USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study that assists local groups in conserving and developing natural resources; Divide, McKenzie, & Williams Co; FY 82 funding $100,000.
3-ROOSEVELT CUSTER RC&D AREA, NORTH DAKOTA USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study that assists local groups in conserving & developing natural resources; Adams, Billings, Bowman, Dunn, Golden Valley, Hettinger, Scope, & Stark Co; cost $1.1 million.
4-LEWIS AND CLARK RC&D AREA, NORTH DAKOTA USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study that assists local areas in conserving & developing natural resources; Burleigh, McLean, Mercer, Oliver, Morton, Grant, Sioux, Emmons, Kidder & Sheridan Co; cost $884,000.
5-RANDALL RC&D AREA, SOUTH DAKOTA USDA/Soil Conservation Service Comprehensive Also in Eastern Dakotas Subbasin	Ongoing feasibility study that assists local areas in conserving & developing natural resources; Gregory, Charles Mix, Douglas, Bon Homme, Brule, & Buffalo Co; cost $1.1 million.
6-BLACK HILLS RC&D AREA, SOUTH DAKOTA, WYOMING USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study that assists local areas in conserving & developing natural resources; Butte, Meade, Pennington, Custer, & Fall River Co; cost $322,000.

7-NORTH CENTRAL RC&D AREA, SOUTH DAKOTA USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study that assists local areas in conserving & developing natural resources; Campbell, Walworth, Huges, Hyde, Sully, & Potter Co; cost $567,000.
8-NEBRASKA RIVER BASINS SPECIAL STUDIES USDA/Soil Conservation Service Comprehensive Also in E. Dak., Platte-Nio., and Middle Mo. Subbasins	Ongoing special studies of erosion, sediment, rural water, & flooding in Mo trib. & White-Hat basins; prime farmland mapping in Platte critical habitat areas; cost is $1,334,000; FY 79-84.
9-WATER RESOURCES MONITORING W. CENTRAL COAL REGION, N. DAKOTA DOI/Geological Survey Comprehensive	Ongoing data collection program involving additional gaging stations in the coal mining region of North Dakota; total cost $415,000.
FLOODING	
10-BELFIELD WATERSHED PROJECT, NORTH DAKOTA USDA/Soil Conservation Service Flooding and Land Cons. & Mgt.	Approved for planning project for flood protection that includes 2 flood retention structures and land treatment; Stark & Billings Co; total cost $1 million scheduled after 1980.
11-MUSKRAT LAKE WATERSHED PROJECT, NORTH DAKOTA USDA/Soil Conservation Service Flooding and Land Cons. & Mgt	Approved for planning project for flood protection that includes land treatment scheduled after 1980; total cost to be determined.
12-SQUARE BUTTE WATERSHED PROJECT, NORTH DAKOTA USDA/Soil Conservation Service Flooding and Land Cons. & Mgt.	Watershed under construction for flood protection that includes 5 flood retention structures, one mile of floodway & land treatment; Morton & Oliver Co; cost $3.6 million.
13-LOWER HEART RIVER AT MANDAN, NORTH DAKOTA Army Corps of Engineers Flooding	Ongoing implementation study to reevaluate adequacy and level of protection of an existing levee project; completion FY 82; total cost $158,000.

FISH AND WILDLIFE

14-GARRISON DIVERSION UNIT SPECIAL STUDY, NORTH DAKOTA DOI/Fish and Wildlife Service Fish and Wildlife	Ongoing special study to identify and manage habitat for mitigation; FY 81 $170,000, FY 82 $185,000.
15-INVENTORY OF SMALL DAMS AND SITES FOR WATERFOWL PRODUCTION DOI/Fish and Wildlife Service Fish and Wildlife	Ongoing data collection program to identify and evaluate small impoundments for waterfowl.

IRRIGATION

16-COOPERATIVE IRRIGATION WATER CONSERVATION STUDY, WYOMING USDA/Soil Conservation Service Irrigation Also in Yellowstone and Platte-Niobrara Subbasins	New start special study of irrigation systems to improve efficiency of distribution and use; total cost $1,140,000; programmed thruugh FY 85.
17-REHABILITATION OF EXISTING IRRIGATION SYSTEMS, MT USDA/Soil Conservation Service Irrigation, Land Conservation, & Management Also in Upper Missouri & Yellowstone Subbasins	New start special study to develop inventory of problems and to identify costs and benefits to rehabilitate irrigation systems; cost FY 81 $122,000.
18-GRASS ROPE UNIT, SOUTH DAKOTA DOI/Water and Power Resources Service Irrigation	Ongoing implementation program with completed plans to develop an additional 3,490 acres of irrigable land in Lyman Co.; ready for construction funds, estimated cost $13 million.
19-APPLE CREEK UNIT, NORTH DAKOTA DOI/Water and Power Resources Service Irrigation, M&I Rural Supply, F&W	Resumption of feasibility study to investigate and develop plans to deliver water from Missouri River for Irrig., M&I Supply, F&W; Burleigh, Kidder and Emmons Co; total cost $898,000.

20-APPLE CREEK UNIT GROUND WATER STUDIES, NORTH DAKOTA North Dakota State Water Commission Irrig., M&I Rural Supply, F&W, Flood, Energy, Water Qual.	Feasibility study to investigate ground water as a potential supplemental water source as part of the ongoing Apple Creek Unit; total cost $150,000 over 2 yrs.
21-POLLOCK-HERREID UNIT, SOUTH DAKOTA DOI/Water and Power Resources Service Irrigation, F&W, M&I Rural Supply	Ongoing program implementation to divert water from Oahe reservoir to irrigate 15,000 acres and for rural needs; Total cost $1,249,000.
22-LOWER BRULE INDIAN RESERVATION AREA, SOUTH DAKOTA DOI/Water and Power Resources Service Irrigation, M&I Rural Supply	New start appraisal study to assess the irrigation potential on the Lower Brule Indian reservation; Total cost $302,000.
23-OAHE RIVERSIDE IRRIGATION STUDY, SOUTH DAKOTA DOI/Water and Power Resources Service Irrigation	New start appraisal study to examine irrigation potential; Campbell, Walworth, Potter, Sully, Hughes & Hyde Co; Total cost $754,000.
24-REEVALUATION OF PINE RIDGE IRRIGATION UNIT, SOUTH DAKOTA DOI/Water and Power Resources Service Irrigation	New start feasibility study to reassess a proposal to irrigate 6,940 acres on the Pine Ridge Indian Reservation.
25-LOWER JAMES-FORT RANDALL WATER DIVERSION PROPOSAL STUDY DOI/Water and Power Resources Service Irrigation Also in Eastern Dakotas Subbasin	Ongoing feasiblity study to be completed in FY 83; project may divert water from Missouri River into Lower James & Fort Randall Conservancy sub-districts; study cost is $1.1 million.
26-GREGORY COUNTY WATER SUPPLY STUDY, SOUTH DAKOTA USDA/Farmers Home Administration Irrigation, M&I Rural Supply	New start feasibility study to determine availability & costs to supply water for irrigation & municipal and rural users.
LAND CONSERVATION AND MANAGEMENT	
27-MONTANA TIMBER WATER FEDERAL-STATE COOPERATIVE SPECIAL STUDY USDA/FS, ESCS, SCS & Montana Dept. of Natural Resources and Conservation Land Conservation and Management and Water Quality Also in Upper Missouri & W. Dakotas Subbasins	New start special study with SCS, ESCS, FS, and Montana DNR to determine effects of timber harvest on water yield and sedimentation; cost FY 80 $115,000; FY 81 $120,000; FY 82 $145,000.

28-MISSOURI RIVER BANK STABILIZATION DEMONSTRATION PROJECT (Sec 32) Army Corps of Engineers Land Conservation and Management Also in Eastern Dakotas Subbasin	Ongoing program implementation to provide stream-bank erosion control at sites along Missouri River by demonstrating new techniques.
29-SALINE SEEPS STUDIES USDA/Soil Conservation Service Land Cons. & Mgt., F&W, M&I Rural Supply, Water Qual.	Ongoing special study to define the extent of the saline seep problem and the effect on agricultural land and water quality.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

30-WESTERN DAKOTAS WATER RESOURCES MGT. PLAN, SD Army Corps of Engineers Municipal, Industrial, and Rural Domestic Water Supply	New start feasibility study to develop a comprehensive water resource mgt. plan for water supply, flood control, and other measures.
31-EASTERN SOUTH DAKOTA AND UPPER BIG SIOUX RIVER STUDY Army Corps of Engineers M&I Rural Supply and Flooding Also in Eastern Dakotas Subbasin	Ongoing feasibility study to examine water supply needs for urban and rural areas in S. Dakota east of the Mo. River & to coordinate development efforts; completed in FY 83; cost is $2.5 million.
32-MINOT EXTENSION REFORMULATION, NORTH DAKOTA DOI/Water and Power Resources Service Municipal, Industrial, and Rural Domestic Water Supply	Resumption of feasibility study to investigate alternate water supplies for Minot, ND; total cost $250,000.
33-VERSIPPI UNIT FEASIBILITY, NORTH DAKOTA DOI/Water and Power Resources Service Municipal, Industrial, and Rural Domestic Water Supply	Ongoing feasibility study to study solutions to solve water supply problems for Dickinson, ND; total cost $130,000.

34-EVALUATION OF AQUIFER DISTURBANCES DOI/Geological Survey M&I Rural Supply, Water Qual.	New start special study effects of exploration on ground water aquifers 2 yr. study; total cost $90,000.
35-WEST RIVER AQUEDUCT STUDY South Dakota Dept. of Water and Natural Resources M&I Rural Supply, Irrig., Energy, Legal & Inst.	Ongoing feasibility study to provide water to W. South Dakota & E. Wyoming by a pipeline from the Missouri River for rural needs & energy; cost averages $7,000 each year.
36-GARRISON DIVERSION UNIT M&I WATER SUPPLY FACILITIES STUDY DOI/Water and Power Resources Service M&I Rural Supply Also in Eastern Dakotas Subbasin	Ongoing feasibility study to develop detailed plans for delivery of water from features of the Garrison Unit to North Dakota communities; completion in FY 83; cost is $821,000.
NATURAL, HISTORIC, AND CULTURAL RESOURCES	
37-KNIFE RIVER INDIAN VILLAGE NATIONAL HISTORIC SITE DOI/National Park Service Natural, Historic and Cultural	Ongoing program implementation to develop a historic site of the Hidatse Indians; total cost $2.4 million.
POWER AND ENERGY	
38-MISSOURI RIVER REVIEW REPORT, NEBR., MONT., N. & S. DAKOTA Army Corps of Engineers Power and Energy	Resumption of feasibility study to consider additional hydropower units at Fort Randall, Oahe, Ft. Peck & Garrison Dams, additional pumped storage at Lake Sakakawea & fish rearing facilities at lakes Oahe and Francis Case; cost FY 81 $500,000, FY 82 $500,000.

WATER-ASSOCIATED OUTDOOR RECREATION

39-RECREATIONAL AREAS BELOW GARRISON DAM (Sec 32)
Army Corps of Engineers
Recreation

New start program implementation to acquire & develop 3 sites below Garrison Dam; schedule not established; total cost $213,000.

TRANSPORTATION

WATER QUALITY

LEGAL AND INSTITUTIONAL FACTORS

40-INDIAN RESERVATION WATER RIGHTS
DOI/Bureau of Indian Affairs
Legal and Institutional Factors

Ongoing feasibility study to identify the water resource base, present & future requirements and to formulate a plan selecting programs to meet the needs on Ft. Berthold Reservation; Cost $126,000.

INSTREAM FLOWS

41-INSTREAM FLOW TECHNICAL STUDY
South Dakota Dept. of Game, Fish, and Parks
Instream Flows
Also in Eastern Dakotas Subbasin

Ongoing special study to evaluate instream flow methodologies and determine water quantity needs.

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. Flooding is a problem in rural areas throughout this subbasin. Specific problem areas in South Dakota include the Battle Creek and Bear Butte watersheds and in North Dakota along Apple Creek, Painted Woods Creek, Shell Creek, and the Little Missouri River. These areas are currently without any programs to determine the extent and magnitude of rural flooding or to consider corrective measures to abate and remedy the flooding problem. Rural flooding problems, particularly those mentioned above, should be addressed by the Soil Conservation Service in cooperation with State water planning agencies.

B. The water supply problems for irrigation are being considered by the Water and Power Resources Service's Water Management Study Missouri River Upstream of Gavins Point. Potential solutions to irrigation water-shortage problems should be available from this study shortly. However, some earlier irrigation studies need to be reassessed. Studies of the Grand, Moreau, Cheyenne, Lower Belle Fourche, Bad, and White River Basins completed from 25 to 40 years ago should be reviewed and updated by the Water and Power Resources Service.

C. The lack of water-oriented outdoor recreation facilities and public access at lakes and streams are problems throughout this subbasin. It is recommended that individual State recreation programs examine alternatives for improving facilities and public access for water-based recreation.

D. Shallow wells used for domestic water supply purposes in rural areas of North Dakota have been affected by seismic exploration, sometimes impairing the supply and quality of water. It is recommended that the Geological Survey study alternatives to alleviate this problem.

E. Stream bed aggradation in the headwaters areas of the Missouri River main stem reservoirs is causing high ground water table and salinity problems. It is recommended that the Corps of Engineers review this problem for potential solutions or mitigation alternatives.

F. The Missouri River Review Report of the Army Corps of Engineers, completed in 1978, recommended feasibility study

and installation of additional hydroelectric units at Garrison Dam and a pumped storage hydroelectric facility at Lake Francis Case in Gregory County, South Dakota. In addition, the review report recommended fish rearing facilities for reinstitution of northern pike fisheries at Lake Oahe and Lake Francis Case. It is recommended that the Army Corps of Engineers be authorized to proceed with advanced planning studies for these facilities beginning in FY 1981.

G. The Missouri River Basin Commission completed the Yellowstone River Basin and Adjacent Coal Area Level B Study in November 1978. Recommendations from this study include modifications or additions to Federal laws, policies, or priorities and the State of North Dakota's laws and policies. These revisions and changes, which are summarized below, are intended to suggest courses of action which will further water resource management on a coordinated basis.

Suggested revisions in Federal laws, policies, or priorities include:

Accelerate ongoing comprehensive studies of irrigable land
Accelerate research on cropping and tillage practices
Manage rangeland to encourage the maintenance and protection of native grasslands
Return a fair profit over costs to producers of grain and livestock
Develop pollution standards for all toxic materials emitted from coal conversion facilities
Increase research on rehabilitation of strip mined lands
Increase research on renewable resources for energy use
Fund streambank protection works
Survey historic, archaeological, and other unique areas
Develop a uniform method of inventorying recreation resources and capabilities
Expand and maintain a comprehensive water quality monitoring network
Develop environmental projections using varying assumptions about future economic conditions
Accelerate programs for acquiring environmental base data
Expand funding for air quality sampling network

The recommended North Dakota legal and institutional changes include:

Require a certificate of soil and water compatibility for irrigation
Enact an Agricultural Lands Protection Act to protect agricultural lands
Limit amount of allowable acreage on irrigation water permits
Provide low-interest loans for agricultural products processing plants
Plan for land use to provide for the orderly growth of North Dakota communities
Preserve public conservation efforts through State policies and programs
Reserve water for future use
Reexamine State water allocation procedures and policies
Strengthen water rights monitoring program
Strengthen land reclamation law
Enact Surface Owners Protection Act
Enact industrial development tax
Accelerate flood plain survey
Provide for instream flow as a beneficial use
Establish a ground-water quality and quantity surveillance and data reporting program
Control and monitor instream sediment
Assess public proposals having significant impact on the environment

H. The Yellowstone Level B Study recommended that the Soil Conservation Service undertake action to address rural flooding problems in North Dakota tributaries situated in the Western Dakotas Subbasin. Two programs were proposed--one for flood control near Hazen, North Dakota, and the other the Cabin Creek Project in Northeast Wyoming. The Cabin Creek project includes a proposal to construct a dam for flood control, using the impounded water for irrigation. This project should be undertaken as part of this recommendation.

I. To address the problem of soil erosion and improve water quality the Yellowstone Level B Study recommended accelerated land treatment on 1,787,000 acres of private and

State lands, 14,000 acres of public lands, and 5,500 of forest lands. To implement this recommendation, action is required by the Soil Conservation Service, the Forest Service, and the Bureau of Land Management. Acreages and treatment cited above are subject to modification through further planning. This plan recommends continuation of this proposal by these agencies named.

J. In order to preserve an irreplaceable archaelogical resource and a natural setting, the Yellowstone Level B Study recommended that the Army Corps of Engineers study the erosion problems at the Knife River Historical Site. This study should be conducted in the near-term future.

K. The Yellowstone Level B Study recommended three multipurpose projects, the Cannonball Unit, Thunderhawk Unit, and Broncho Reservoir, to be studied by the Water and Power Resources Service. Each of these projects would provide water for municipal, rural domestic, and industrial use, provide flood control, and provide irrigation water to new acreage. It is recommended that the Service undertake appraisal level studies for these proposed projects.

L. Preservation and management of rare and unique woodland areas by the North Dakota State Forestry Department was proposed in the Yellowstone Level B Study. It is recommended that this State agency assume the responsibility for this objective in the near-term future.

M. In order to retain options for preserving certain North Dakota rivers and streams, the Yellowstone Level B Study recommended that the Heritage Conservation and Recreation Service undertake studies to determine possibilities for State and national preservation. Potential State recreational river reaches include the Yellowstone River, 22 miles from the North Dakota State line to the Missouri River; the Knife River, 76 miles from Manning, North Dakota, to the Missouri River; and the Cannonball River, 45 miles from Shields, North Dakota, to North Dakota Bridge 1806. Designation is possible for the the Missouri River for 86 miles in North Dakota as a national scenic river. It is recommended that the Heritage Conservation and Recreation Service undertake these studies.

N. The Yellowstone Level B recommended that the Fish and Wildlife Service designate flow rates needed for

conservation of fish and wildlife on selected streams in North Dakota tributaries. The streams selected include the north fork of the Grand River, Cannonball River, Little Missouri River, Knife River, and the Heart River. This recommendation should be implemented in the near term future.

CHAPTER 6

EASTERN DAKOTAS SUBBASIN

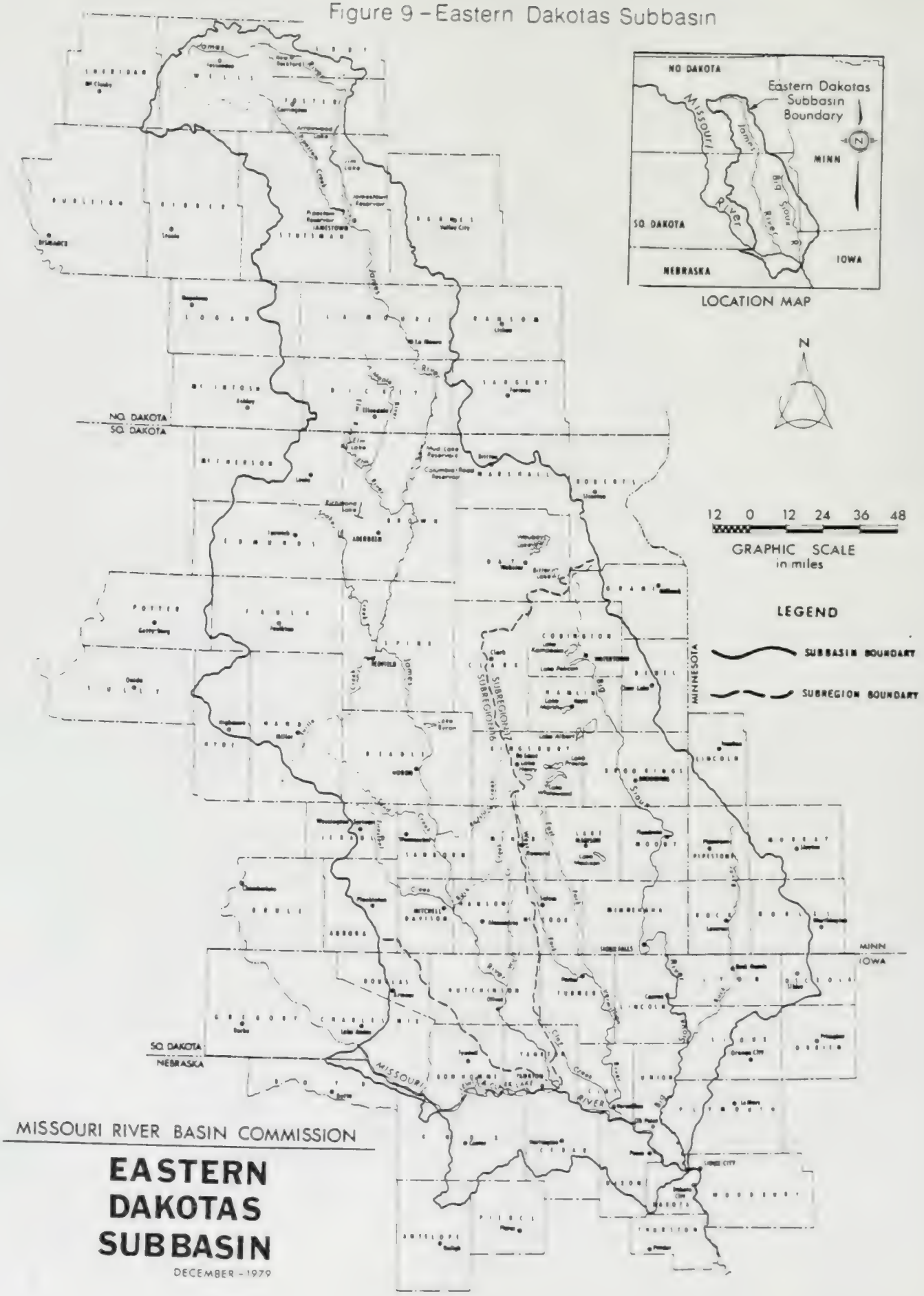
SUBBASIN DESCRIPTION

The Eastern Dakotas Subbasin is a 22.7 million acre area lying in the northeastern section of the Missouri River Basin. Figure 9 shows that the subbasin includes all of the land drained by the Missouri River and its tributaries from Fort Randall Dam near the South Dakota-Nebraska border downstream to Sioux City, Iowa, excluding the drainages of the Niobrara River and Ponca Creek. The subbasin lies mainly in North Dakota and South Dakota but also includes portions of Minnesota, Nebraska, and Iowa. The subbasin extends about 300 miles in a north-south direction; the maximum east-west extent is 150 miles. Principal rivers include the James, Big Sioux, and Vermillion.

The main topographic feature of the subbasin is its flatness. The James River has the flattest gradient of any river of its length in North America. Substantial areas do not contribute to surface runoff; precipitation evaporates before it runs off. The gradient of the James averages about 0.05 feet per mile through the nearly 2,000 square mile Dakota Lake Plain area in northern South Dakota. It takes water nearly twice as long to reach the Missouri River mouth from the uppermost point of this subbasin than it does from anywhere else in the Missouri Basin.

Agricultural ecosystems, including small grains, row crops, and pasture lands, dominate the landscape in much of this subbasin. However, in some hilly, rocky pothole areas, native ecosystems of mixed grass and tall grass prairies exist. Woodland areas occur as shelterbelts around farmsteads; as

Figure 9 - Eastern Dakotas Subbasin



MISSOURI RIVER BASIN COMMISSION

EASTERN DAKOTAS SUBBASIN

DECEMBER - 1979

wildlife plantings; along some portions the Missouri, James, Big Sioux, and Vermillion Rivers; and near some natural lakes. These limited areas provide key habitats for whitetail deer, eastern cottontail, fox, tree squirrels, raccoon, songbirds, birds of prey, wood duck, and ring-necked pheasant. Nationally significant wetlands occur in the northern portion of the subbasin. These wetlands produce large quantities of waterfowl, especially ducks and provide needed rest stops for migrating species. The bald eagle, an endangered species, lives along the bluffs of the Missouri River.

The human population of the subbasin, estimated at 642,000, is projected to grow only 2 percent before 2000, making it the slowest growing subbasin in the Missouri Basin. With fewer people needed to farm the land due to automation and steadily higher farmland values, it is becoming increasingly difficult for people to get started farming. This problem is causing population out-migration, especially of young adults, resulting in an increasingly older average age. The subbasin's only designated Standard Metropolitan Statistical Area, Sioux Falls, South Dakota, is the exception to this trend. From 1960 to 1975, this area grew by 16 percent to 100,100 residents.

Personal income presently trails the national average by about 20 percent and is projected to continue that pattern. Agriculture is the dominant economic activity. Livestock production sales currently comprise three-fourths of all agricultural receipts. Wheat is the primary crop grown in the north, while corn production is dominant in the south.

Water supplies are quite limited in the subbasin. This shortage is illustrated by backlogs of pending and deferred requests for appropriation permits. Surface water is generally intermittent during the year with long periods of little or no water available, except in the lower reaches of the James and Big Sioux Rivers. As the supply of surface water decreases, the quality of the remaining water almost always worsens. The quality of ground water varies among aquifers and within many aquifers. Irrigation is the major use of water, followed by manufacturing, livestock, and municipal systems.

All surface water in the five States is legally considered public property and is allocated only for beneficial uses by the regulatory agency in each State. North Dakota, South Dakota, and Nebraska allocate by the prior appropriation system. Minnesota and Iowa have a permit system based on riparian philosophy.

Beneficial water uses as defined in each State are shown below; uses with higher priority are listed above uses of lower priority under each State heading. South Dakota beneficial uses have not been specifically defined but are referred to in the State Code. Iowa and Minnesota have established protected minimum flows for fish, wildlife, water quality enhancement, and other related purposes. Nebraska law makes no mention of these water uses.

IOWA

Natural uses (domestic and livestock)
Artificial uses (municipal, industrial, and irrigation

NEBRASKA

Domestic
Irrigation
Power and manufacturing

MINNESOTA

(No definition of beneficial uses or their priority)

NORTH DAKOTA

Domestic
Municipal
Livestock
Irrigation
Industrial
Fish, wildlife, and recreation

SOUTH DAKOTA

Domestic
Others uses such as municipal, industrial, irrigation, water quality management, fish, wildlife, and recreation receive equal consideration

PROBLEMS AND OPPORTUNITIES

The major problems in the Eastern Dakotas Subbasin are limited availability of good quality drinking water, rural flooding, loss of wetlands, limited supply of water for irrigation, erosion, and nonpoint source pollution.

Sufficient quantity of surface water for all uses is not readily accessible in the subbasin. Also, availability and quality of ground water are generally unknown. The cities of Sioux Falls, Huron, Aberdeen, Redfield, and Mitchell, South Dakota, and Worthington, Minnesota, are expected to need additional water supply in the future. At the present time, nearly all community water systems in the subbasin fail to meet the quality standards set by the Safe Drinking Water Act. The range of problems may include total dissolved solids, total hardness, iron, manganese, and sulfate.

Ground water is the source of most of the rural domestic water in the subbasin. The quantity of water from these sources has generally been sufficient; however, conflicts between rural domestic supply and large ground water withdrawals for irrigation are emerging in the southern portion of eastern South Dakota and throughout the James River Basin. In addition, the quality of water from these sources is a problem. In most rural households, drinking water does not meet standards established in the Safe Drinking Water Act. This is due to the poor quality characteristics of available ground water and from continued quality degradation from both point and nonpoint sources of pollutants in the area.

Opportunities exist to build rural water systems using high quality surface water, especially from the Missouri River, and possibly ground water. As more rural water supply systems are built or as existing systems increase their service areas, cooperation between systems could reduce costs and the need for additional facilities and water.

On the average, one major flood has occurred along the James River every 15 years. In North Dakota, Jamestown and Pipestem Reservoirs have essentially curtailed major flood damage at Jamestown and downstream to the South Dakota State line. However, the James valley in South Dakota experiences major rural flooding problems. The slope of the James River is much less than that of its tributaries. Thus, flood waters are discharged into the James valley faster than they can be carried away. Very large discharges may cause the flow in the James to reverse, sometimes flowing upstream for several days.

Low stream gradient, silt build-up, and trapped debris near inadequate bridge and culvert openings restrict channel capacity and aggravate flooding in the Lake Plain area in northern South Dakota. Along this reach of the James from Columbia, South

Dakota, to near Redfield, South Dakota, 30,000 acres are subject to prolonged flooding. For most of this reach, a 5 year event floods the entire valley, and the valley remains flooded for two or three months. This area acts as a natural reservoir that prolongs flooding downstream but limits the peak flows. For example, along the James from Foster Creek to the Missouri River, 40,500 acres are flooded in a 10 year flood and 46,000 in a 100 year flood.

The Big Sioux River has caused flooding problems at Brookings, South Dakota, that are compounded by Six Mile Creek runoff; at Flandreau, and Trent, South Dakota, where damages occur almost every year; Dell Rapids, South Dakota, with six floods in 25 years; and Castlewood, Bruce, Watertown, Dempster, and Estelline, South Dakota. Along the Big Sioux River, rural flood damages occur on 34,800 acres upstream of Sioux Falls and 24,600 acres downstream.

Land use changes are causing reductions in wetland acreages throughout the subbasin. Wetlands are being converted to cropland, causing a two percent decline in wetlands annually in some portions of North Dakota. This loss is of special concern in North Dakota and northern South Dakota because the region is very important as a breeding area for migratory waterfowl, especially ducks. Drainage of wetlands may also reduce flood storage capability, nutrient retention, and ground water recharge.

There is considerable interest in expanding the acres of irrigated land because land suitable for irrigation exists in many portions of the subbasin. However, water is not readily accessible from present surface sources in the subbasin. Opportunities do exist to divert water from the Missouri River because most of this subbasin is at a lower elevation than Oahe Reservoir on the Missouri River.

Farm management practices are contributing to soil erosion and surface water quality problems. Water quality problems in the subbasin are caused mainly by nonpoint source pollution. Runoff from native range and cropland, especially in the southern portion of the subbasin and from cropland, with fertilizers, herbicides, and pesticides attached to the sediment causes almost all of the water quality problems in the subbasin. The levels of total solids, nitrogen, and phosphates in most streams and rivers are relatively high. This leads to severe eutrophication of many lakes and reduces the possible uses of surface water. Inadequate

Federal, State, and local funds have been appropriated to implement all five States' nonpoint source pollutant management programs. "Best management practices" of farmlands are recommended in these programs and would alleviate water quality problems, but funding is needed to help landowners implement these practices.

PLANNING OBJECTIVES

Each of the five States in the subbasin has prepared or is preparing a State water plan. In addition, it is an expressed goal of the North Dakota State Water Commission to integrate the Missouri River Basin Commission regional water planning process into North Dakota's water planning process, where possible.

Irrigation objectives reflect east to west precipitation differences. It is the objective of the States of North Dakota, South Dakota, and Nebraska to develop irrigation potential in their States to provide an adequate supply of water for irrigation projects. Iowa and Minnesota planning objectives are tempered by the qualification that water permits for irrigation should be issued on a case by case basis only after all impacts of the proposed irrigation are known and judged to be more beneficial than harmful. Iowa encourages private funding of individual farm irrigation system development; furthermore, the policy dictates public funds should only be used when increased food and fiber production is considered in the general public interest.

All subbasin States want to minimize intrastate flood damage. North Dakota is most specific in its objective to protect agricultural areas from the 25 year flood and limit flooding in urban areas in any year to one percent. Minnesota stresses the use of nonstructural measures.

Protection of the productivity of soils, control of erosion, and reduction of sediment loading in streams and lakes are objectives of all five of the subbasin States. The States agree that incentives should be provided to implement nonpoint source pollutant control programs, including land treatment, bank stabilization, and other "best management practices."

An objective of each of the five States is to meet municipal, industrial, domestic, and livestock water supply and quality needs wherever feasible. South Dakota and Nebraska objectives generally support all methods of providing water to

the user. Iowa and Minnesota qualify that support somewhat by requiring water users to adopt water conservation measures.

Development of hydropower production facilities is generally encouraged in North Dakota; however, possible adverse environmental impacts and loss of additional Missouri River bottomlands cause great concern for installing additional hydropower capacity at Garrison Dam. South Dakota supports possible diversion and use of Missouri River water that may limit hydropower generation. Minnesota opposes any actions that will severely impair hydropower generation in the Missouri River or its delivery to current Minnesota users.

Preservation of key natural areas and maintenance of fish and wildlife habitat are objectives in all five States. Most States feel that these areas should be maintained through temporary leases and easements rather than by title purchases and permanent easements.

PLAN OVERVIEW

The plan for the Eastern Dakotas Subbasin includes the programs listed below under Recommended Programs - Eastern Dakotas, the programs recommended basinwide in chapter 2, and the statewide programs recommended for South Dakota, North Dakota, Iowa, Minnesota, and Nebraska, also shown in chapter 2. There are conclusions and additional recommendations for the Eastern Dakotas Subbasin. A Commission Comprehensive Study of the James River Basin was completed in early 1980, and its results are incorporated into the plan for this subbasin.

As pointed out above, drinking water problems affect most of the residents of the subbasin. Three programs should address most of these problems. A study led by the Army Corps of Engineers, the Eastern South Dakota and Upper Big Sioux River Study, is designed to examine all drinking water problems in eastern South Dakota. When completed in FY 1983, this study should present alternatives and recommended approaches for satisfying many of the municipal and rural domestic water supply needs for the study area. A Water and Power Resources Service study, the Garrison Diversion Unit M&I Water Supply Facilities Study, should help many North Dakota communities solve drinking water problems. The Farmers Home Administration's program to assist development of rural water systems, the basinwide program named, "Rural Water and Waste Disposal Systems" is also a key program in this subbasin.

As in several other subbasins, many Soil Conservation Service small watershed projects are recommended for this subbasin. In general, however, rural flooding problems remain unaddressed. Most structural flood control alternatives such as dams, levees, and large scale channelization are economically, environmentally, or socially unacceptable. Nonstructural flood damage reduction measures such as decreasing use of the flood plain for cropland may be needed. Other alternatives that may help to minimize the problem are a continuing program of channel clearing and snag removal, and a program to prevent sediment deposition in stream channels. However, adequate funding for these programs is not readily available.

Irrigation development can serve the dual role of raising crop productivity and providing a significant economic stimulus to an area whose economic growth rate has lagged behind the national average. Water for irrigation is available from Missouri River reservoirs, and there is irrigable land available in the subbasin at a lower elevation than the reservoirs. Therefore, there are many large scale, publicly funded irrigation project possibilities. The Water and Power Resources Service will examine some of this irrigation potential in northeastern Nebraska and southeastern South Dakota with the Crofton Unit Study and the Lower James-Fort Randall Diversion Unit Study. Construction of the Garrison Diversion Unit, is a program of great importance to this subbasin. This proposal would use Missouri River water to irrigate 250,000 acres in North Dakota, of which about 60,000 acres lie in this subbasin. The remaining acres lie outside of the Missouri River Basin.

Soil Conservation Service studies will examine erosion problems relative to existing land uses to determine necessary conservation measures. The Rural Clean Water Program, a basinwide program which will be administered by the Agricultural Stabilization and Conservation Service, should be an integral program in this subbasin. When funded, the program will help landowners implement conservation practices and address most major erosion and nonpoint source pollution problems.

The problem of loss of wetlands will be addressed by the Agricultural Stabilization and Conservation Service's Water Bank Program, a basinwide program. The State of North Dakota supports this program instead of the Fish and Wildlife Service's Small Wetlands Acquisition Program which was excluded from the plan. The water bank program maintains wetlands through nonbinding 10-year leases while the acquisition program seeks to purchase or obtain a permanent easement on the wetland.

RECOMMENDED PROGRAMS - EASTERN DAKOTAS

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-SOUTH CENTRAL DAKOTA RC&D AREA, SOUTH DAKOTA USDA/Soil Conservation Service Comprehensive	Ongoing program implementation in Wells, Foster, Griggs, Dickey, Stutsman, Logan, Barnes, LaMoure, and McIntosh Counties; a plan of technical and financial assistance for the area was developed in 1979.
2-RANDALL RC&D AREA, SOUTH DAKOTA USDA/Soil Conservation Service Comprehensive Also in Western Dakotas Subbasin	Ongoing project in Gregory, Charles Mix, Douglas, Bon Homme, Brule, and Buffalo Counties that will provide technical and financial assistance to local groups in conserving and developing natural resources.
3-LOWER JAMES RC&D AREA, SOUTH DAKOTA USDA/Soil Conservation Service Comprehensive	Ongoing program implementation in Jerauld, Sanborn, Hutchinson, Aurora, Davison, Hanson, and Yankton Counties; project is implementing a plan of technical and financial assistance that was developed in 1975.
4-WATER MANAGEMENT STUDY UPSTREAM OF GAVINS POINT DOI/Water and Power Resources Service Comprehensive Also in Upper Missouri, Yellowstone & W. Dakotas Subbasins	Ongoing special study of water supply and use; scheduled to be completed in FY81 at a total cost of $871,000, $136,000 of which is programed to be spent in FY 81.
5-NEBRASKA RIVER BASINS SPECIAL STUDY USDA/Soil Conservation Service Also in W. Dakotas, Platte-Niobrara, and M. Missouri Subbasins	Ongoing special study of erosion, sediment, rural water, flooding in Mo. tribs and White-Hat basins; prime farmland mapping in Platte critical habitat areas; FY 79-FY 84 cost is $1,334,000.
FLOODING	
6-FLOOD PLAIN MANAGEMENT PROGRAM FOR THE MISSOURI RIVER Missouri River Basin Commission Flooding and Land Conservation & Management Also in Middle Missouri and Lower Missouri Subbasins	New start special study beginning in FY 81; Missouri River mainstem from near Sioux City, Iowa, to the mouth near St. Louis, Missouri; study cost $400,000.

7-ROCKY RUN CREEK AND OAK CREEK DRAIN North Dakota State Water Commission Flooding	New start construction project possibly beginning in FY 80; project would increase channel capacity by removing sediment and vegetation and by reconstructing some farm machinery and road crossings.
8-ROSS WATERSHED PROJECT, IOWA USDA Soil Conservation Service Flooding and Land Conservation & Management	Watershed in Plymouth County is recommended for planning; project would have 11 grade stabilization structures and cost $600,000.
9-CHAMPEPEDAN WATERSHED PROJECT, MINNESOTA USDA Soil Conservation Service Flooding and Land Conservation & Management	Watershed in Murray, Nobles, and Rock Counties is recommended for planning; project would have 2 flood detention structures, some land treatment, and cost $1,750,000.
10-TURKEY-CLAY CREEK WATERSHED PROJECT, SOUTH DAKOTA USDA Soil Conservation Service Flooding and Land Conservation & Management	Planning is scheduled to begin in FY 81; project in Clay, Yankton, and Turner Counties includes 10 flood detention & 2 grade stabilizing structures, land treatment and channel work; cost is $7,100,000.
11-SIX MILE CREEK WATERSHED PROJECT, SOUTH DAKOTA USDA Soil Conservation Service Flooding, Land Conservation & Management, and Recreation	Planning is scheduled to begin in FY 82; project in Brookings and Deuel Counties includes multiple purpose structures, land treatment, and channel work at a cost of $1,100.000
12-AOWA CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding, Land Conservation & Management, and Recreation	Project in Dixon County is under construction and is expected to be completed in FY 86; structures include 55 grade stabilization, 8 flood detention, and 2 multipurpose; total cost $4,200,000.
13-MISSION HILL WATERSHED PROJECT, SOUTH DAKOTA USDA Soil Conservation Service Flooding and Land Conservation & Management	Project in Yankton County has been approved for construction. Measures include land treatment, channel work, and 1 flood detention structure. Estimated cost is $330,000.

14-SPRING-BULL CREEK WATERSHED PROJECT, SOUTH DAKOTA
USDA/Soil Conservation Service
Flooding and Land Conservation & Management

Project in Charles Mix Co. is under construction and is expected to be completed in FY 81; structures include 3 flood detention and 2 grade stabilization; cost of $1 million.

15-UNION CREEK WATERSHED PROJECT, SOUTH DAKOTA
USDA/Soil Conservation Service
Flooding and Land Conservation & Management

Project in Union County is under construction and is expected to be completed in FY 82; structures include 4 flood detention and 13 grade stabilization; cost of $745,000.

16-HURLEY CREEK WATERSHED PROJECT, SOUTH DAKOTA
USDA/Soil Conservation Service
Flooding and Land Conservation & Management

Project in Turner County is approved for construction and is expected to be completed in FY 85; land treatment, channel work, and 1 flood detention structure are included; cost of $589,000.

17-BRULE CREEK WATERSHED PROJECT, SOUTH DAKOTA
USDA/Soil Conservation Service
Flooding and Land Conservation & Management

Project in Lincoln and Union Counties is under construction. Completion is expected in FY 86; includes land treatment, channel work, 17 flood and 3 grade structures; cost is $2 million.

18-UPPER CROW CREEK WATERSHED PROJECT, SOUTH DAKOTA
USDA/Soil Conservation Service
Flooding and Land Conservation & Management

Project in Marshall County should be reevaluated in FY 81 or as soon as possible.

19-LOWER CROW CREEK WATERSHED PROJECT, SOUTH DAKOTA
USDA/Soil Conservation Service
Flooding and Land Conservation & Management

Project in Brown County should be reevaluated possibly in FY 81. Planning on this watershed must be conducted with or following that for Upper Crow Creek Watershed.

FISH AND WILDLIFE

IRRIGATION

20-MODIFICATION OF EXISTING IRRIGATION SYSTEMS
USDA/Soil Conservation Service
Irrigation, Energy, and Land Conservation and Management

Ongoing implementation program aids farmers in modifying existing irrigation systems that have inefficient water delivery methods.

21-CROFTON UNIT STUDY DOI Water and Power Resources Service Irrigation, Flooding, F&W, M&I Rural Supply, and Recreation	New start feasibility study scheduled beginning in FY 82; Near Bow Creek & Mo. River in northwestern Knox & Cedar counties Nebraska; Project would irrigate 60,000-100,000 acres; study cost is $2 million.
22-LOWER JAMES - FORT RANDALL WATER DIVERSION PROPOSAL STUDY DOI Water and Power Resources Service Irrigation Also in Western Dakotas Subbasin	Ongoing feasibility study to be completed in FY 83; Project may divert water from Missouri River into Lower James & Fort Randall Conservancy subdistricts; study cost is $1.1 million.
23-GARRISON DIVERSION UNIT DOI Water and Power Resources Service Irrig., Flood., F&W, M&I Rural Supply, and Water Qual.	Authorized project to use 871,000 acre-feet of water annually to irrigate 250,000 acres in central and eastern North Dakota; total cost may be $612 million.

LAND CONSERVATION AND MANAGEMENT

24-WESTERN IOWA RIVERS COOPERATIVE STUDY USDA Soil Conservation Service Land Cons. and Mgt., Flood., Irrig., and Water Qual. Also in Middle Missouri Subbasin	New start river basin planning study to begin in FY 82; total cost is expected to be about $1.4 million.
25-LOWER JAMES COOPERATIVE RIVER BASIN STUDY USDA Soil Conservation Service Land Conservation & Management, and Irrigation	New start special study beginning FY 80 and ending FY 81; examination of existing land uses to determine changes needed to maximize income w/o degrading soil resources; total cost $267,000.

26-SHELTERBELT RESTORATION PROGRAM USDA/Agricultural Stabilization and Conservation Service Land Conservation and Management, Fish and Wildlife	Ongoing program in conjunction with N. & S. Dakota game and fish agencies to help private landowners restore damaged shelterbelts and to prevent losses of existing shelterbelts.
27-MISSOURI RIVER BANK STABILIZATION DEMONSTRATION PROJECT (Sec 32) Army Corps of Engineers Land Conservation & Management Also in Western Dakotas Subbasin	Ongoing program to provide streambank erosion control measures at 22 sites below Gavins Point Dam, 7 sites below Fort Randall Dam, 1 site below Oahe Dam, and 22 sites below Garrison Dam.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

28-EASTERN SOUTH DAKOTA AND UPPER BIG SIOUX RIVER STUDY Army Corps of Engineers M&I Rural Supply and Flooding Also in Western Dakotas Subbasin	Ongoing feasibility study to examine water supply needs for urban & rural areas in S. Dakota east of the Mo. River & to coordinate development efforts; completed in FY 83; cost is $2.5 million.

NATURAL, HISTORICAL AND CULTURAL

POWER AND ENERGY

29-BOYD COUNTY PUMPED STORAGE POWER PROJECT Nebraska Public Power District Energy and Recreation	New start final design and construction of 1336 MW pumped storage power plant, near Lynch in Boyd Co.; two reservoirs of 74,000 & 60,000 acre-ft. will be constructed; project cost is $616,700,000.

WATER-ASSOCIATED OUTDOOR RECREATION

30-MISSOURI RIVER NATL. RECR. RIVER MGMT. PLAN IMPL. Army Corps of Engineers Recreation	New start implementation of management plan; national recreation river designation applies to Missouri River from Gavins Point Dam to Ponca (NE) State Park.

TRANSPORTATION

WATER QUALITY

LEGAL AND INSTITUTIONAL FACTORS

INSTREAM FLOWS

31-INSTREAM FLOW TECHNICAL STUDY

South Dakota Dept. of Game, Fish, and Parks
Instream Flows
Also in Western Dakotas Subbasin

Ongoing special study to evaluate instream flow methodologies and determine water quality needs.

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. The city of Sioux Falls, South Dakota, is in need of additional supplies of municipal and industrial water. A project to supply water to Sioux Falls, called the Sioux Falls Unit, has been proposed by the Water and Power Resources Service (WPRS) based on studies that have been completed. The South Dakota Department of Water and Natural Resources supports the city of Sioux Falls in attempting to meet its future water needs and stands ready to assist WPRS in the location and evaluation of data on the Sioux Falls Unit.

B. Due to substantial opposition to the Initial Stage Oahe Unit in the project area, the project as presently authorized will probably not be built. The Oahe Unit was originally designed and viewed partially as an effort to offset the loss of farmland incurred by the State of South Dakota for the construction of Missouri River reservoirs. The Initial Stage Oahe Unit should not be deauthorized until other programs to offset those losses are fully identified and commitments are made by the Federal Government to pursue such programs.

C. Many parts of eastern South Dakota have a great need for improved domestic water supply, both in terms of water quality and quantity. There is also interest in irrigating large amounts of land. Federal funding should be made available for studying and constructing domestic and irrigation water supply facilities. The Water and Power Resources Service should conduct studies to include looking at use of already constructed Oahe Unit facilities and examining other possible irrigation sites in the State. Also, the Corps of Engineers should examine domestic water supply alternatives in their ongoing Eastern South Dakota and Upper Big Sioux River Study.

D. The Water and Power Resources Service is conducting a study of irrigation development possibilities called the "Lower James-Fort Randall Water Diversion Proposal Study." The possible uses of the nearly complete Oahe pumping plant, Pierre canal, and other features of the Initial Stage Oahe Unit should be examined through this study.

E. One area that has a need for improved domestic water supply

is in north-central South Dakota. A pipeline from the Missouri River for providing treated water into a nine-county area has been studied largely throught the use of local funds. This proposal is called the WEB pipeline. Federal funding, possibly from the Department of the Interior, should be made available to conduct a feasibility study of the WEB pipeline.

F. Many interstate water related issues have surfaced during the Commission's James River Basin Subregional Analysis. In order to resolve these issues, better communication and coordination are needed between Federal, State, and local water resources organizations. The Missouri River Basin Commission should establish an Ad Hoc James River Interstate Coordinating Committee to facilitate this communication and coordination.

G. The James River is almost like two rivers; one upstream of Sand Lake National Wildlife Refuge and another entirely different river downstream. The hydrologic effects of Sand Lake need to be known in order to formulate a plan for water management in the James River Basin. When established by the Missouri River Basin Commission, the James River Interstate Coordinating Committee should undertake such a study.

H. The average channel capacity in much of the lake plain area of the James River has been reduced by as much as two-thirds in some places. Deposition of sediment is the main reason for this reduction. The Army Corps of Engineers should conduct a study of the sources of sediment and evaluate alternative methods of reducing sediment inflow.

I. There is inadequate water supply and water use data available for the James River Basin. A hydrologic model of the river would assist in formulating a James River Basin water management and operations plan. The Water and Power Resources Service should undertake a water management study of the entire James Basin which would develop a hydrologic model of the river. This study should be conducted after or during the proposed analyses of Sand Lake National Wildlife Refuge and of sedimentation in the James channel.

J. Many ground and surface water quality data are collected in both North Dakota and South Dakota; however, these two sets of data are often incompatible. Data have very limited use outside the State in which they were collected. All water

quality data should be standardized to allow better utilization of data, fill data gaps, and avoid erroneous conclusions based on an incomplete monitoring network. All agencies collecting such data in North and South Dakota should coordinate their activities. A series of annual meetings should take place involving the U.S. Environmental Protection Agency and Geological Survey; South Dakota Departments of Water and Natural Resources, Agriculture, and Geological Survey; and North Dakota Departments of Health, State Water Commission, and Geological Survey.

K. The Soil Conservation Service conducts a program of providing technical assistance to private landowners for planning and applying measures needed to help conserve soil, water, and related resources called the "Soil Conservation Program." The budget for this program has been stable or declining for the last 15 years so the program is greatly reduced from what it has been in the past. Funding for the program needs to be greatly accelerated to make the program comparable to that of 15 years ago so that pressing soil erosion problems can be adequately addressed.

L. Rural flooding problems are recurrent in the subbasin, especially in the James River lake plain area where the 10 year flood covers almost as much land as the 100 year flood. Many studies of the rural flooding problem have been conducted, but structural solutions to the problem that are economically, environmentally, and socially acceptable have not been found. Current planning policies and criteria will not permit the implementation of programs and projects to alleviate these rural flooding problems.

M. Many trees, especially dead Elms, and other obstructions cause localized flooding problems along the James River. Some programs are now underway to remove these obstructions; however, these are one-time programs. A continuing program is needed to ensure these flooding problems do not reoccur. In South Dakota, State funds should be made available to the Lower James and Oahe Conservancy Subdistricts to develop a continuing program to monitor the condition of the James River channel and periodically remove obstructions. This continuing program would replace short term programs of the past. No change in the present program is needed in North Dakota.

N. Numerous streambanks and lakeshores in South Dakota, especially in the James River Basin, are being damaged by improper land use. A State review and permit system is needed to resolve these inappropriate land uses. The South Dakota Department of Water and Natural Resources should develop legislation to guide this State review and to regulate the proposed use of lakeshores, streamside areas, and other scenic areas.

O. Along many reaches of the James River the streambank is eroding. Maintenance of a balanced ecosystem of live trees, brushy cover, and grasses along the streambank would reduce the erosion problem. The Lower James and Oahe Conservancy Subdistricts in South Dakota and the Garrison Conservancy District and County Water Management Districts in North Dakota should encourage landowners along the James River to maintain such an ecosystem.

P. Approximately 50 feedlots have been identified as pollutant sources in the James River Basin. Further study probably would identify about 80 more feedlots within the basin and numerous others in South Dakota that are also pollutant sources. The U. S. Environmental Protection Agency has not actively enforced water quality regulations to eliminate these discharges. Pollution from the feedlots should be eliminated. The South Dakota Legislature should provide funding to resume the State Feedlot Pollutant Discharge Elimination Program. This program provides matching money to help feedlot owners construct treatment facilities and holding lagoons. Also, the Legislature should grant the Department of Water and Natural Resources authority to assume full responsibility for point source discharge regulation from EPA in FY 1982. EPA would still provide DWNR with most of the funding for the program.

Q. Individual human waste-water systems are causing pollution problems in South Dakota. The South Dakota Department of Water and Natural Resources now has authority to enforce existing regulations and with limited resources enforces only on a complaint basis. This enforcement program should be moved to the local governmental level in order to better monitor systems and their problems. Municipal and county governments should adopt and enforce DWNR regulations or enact regulations more stringent than DWNR's to control this problem. Technical assistance should be provided by the DWNR.

R. Both North and South Dakota participate in State Comprehensive Outdoor Recreation Planning (SCORP). There is a need in the James River Basin to examine certain water-related aspects of SCORP activities in more detail. To determine the need for improved or additional recreation facilities at lakes and reservoirs, the existing public and private facilities, level of usage, and the potential for additional facilities should be assessed. To determine if a specific section of the James River should be considered for recreation development, a survey of demand for corridor recreation along the river should be conducted. An analysis of the level of funding needed to properly maintain, police, and manage existing water related recreation facilities should be undertaken. In North Dakota, these three studies should be conducted by the Department of Parks and Recreation; in South Dakota by the Department of Game, Fish, and Parks.

CHAPTER 7 – PLATTE–NIOBRARA SUBBASIN

CHAPTER 7

PLATTE-NIOBRARA SUBBASIN

SUBBASIN DESCRIPTION

The Platte-Niobrara Subbasin extends from the southwestern portion of the Missouri River Basin in Colorado and Wyoming eastward through Nebraska to the Missouri River. As indicated in figure 10, the subbasin includes lands drained by the Platte and Niobrara Rivers and Ponca Creek for a combined area of 63.7 million acres in Colorado, Wyoming, Nebraska, and South Dakota. The subbasin extends about 600 miles in an east-west direction and about 300 miles in a north-south direction at its widest point. Topography varies greatly; its western boundary is the top of the continental divide in Colorado and Wyoming while the flood plain of the Missouri River forms part of its border in the east.

The Platte River is formed by the junction of the North and South Platte Rivers in west central Nebraska; from there it flows across Nebraska to the Missouri River. The Niobrara River flows along the subbasin's northern edge, emptying into the Missouri River above Lewis and Clark Lake.

The character of the natural environment is highly diverse. Mountainous, forested tracts give way to foothills and high plains in the far west. These areas support large populations of big game animals and high quality cold water fisheries. Moving eastward, land use is dominated by intense agricultural activity. The subbasin's agricultural lands provide important habitat for a variety of birds and small animals. The streams, sand pits, ponds, and lakes across Nebraska and in eastern Wyoming and Colorado provide warm water fish habitat.

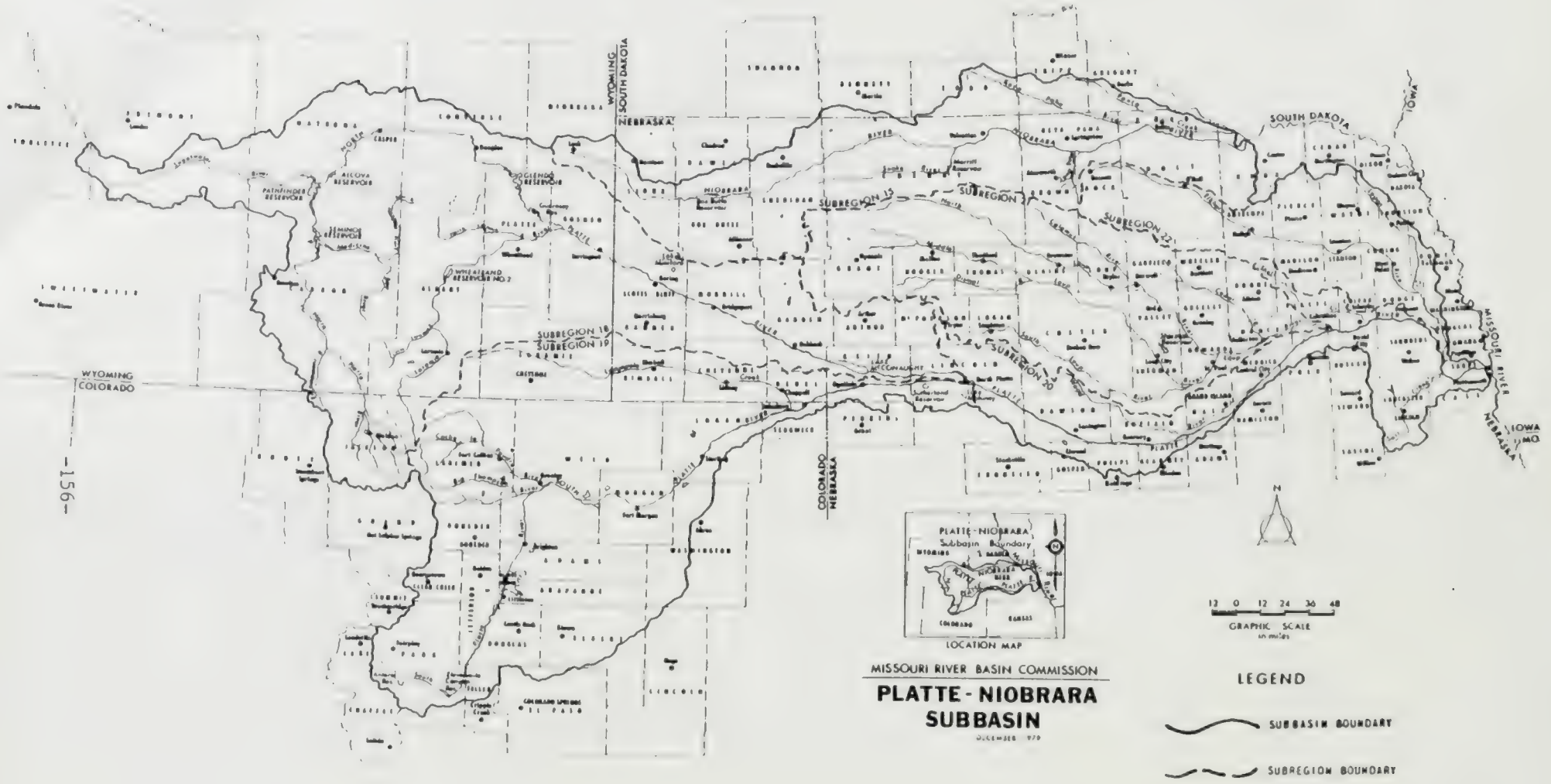


Figure 10 - Platte - Niobrara Subbasin

Natural formations of significant esthetic values exist in the subbasin, especially the scenic vistas in the Rocky Mountains and the unique Sand Hills terrain. The area is also historically rich, providing traces of the history of the pioneer settlers, westward railroad development, military outposts, and mining activities.

The subbasin's 1975 population was estimated to be 2.7 million persons. Eighty percent lived in urbanized areas; most of these in the three Standard Metropolitan Statistical Areas along Colorado's front range. The rural component of the population is projected to decline further during the remainder of the century.

The subbasin supports a diverse economy, including agriculture, manufacturing, mining, forestry, and recreation. Denver, Colorado, is the dominant economic nucleus, supported in part by the vast agricultural activities and natural resources found throughout the basin.

Typical of the entire Missouri River Basin, water availability is highly variable across the Platte-Niobrara Subbasin. Flows in the Platte River drainage are subject to extreme seasonal fluctuations caused by high spring runoff and extensive irrigation development. Flows in the Niobrara and its tributaries are more regular due to subsurface inflows from the Sand Hills, under which lie vast ground water reservoirs. Outside of the Sand Hills, major sources of ground water are the Ogallala aquifer and stream alluvia. Extensive ground water pumping occurs along the Platte, South Platte, and Niobrara Rivers.

Irrigation is the dominant water use in the subbasin; withdrawals totaled some 12.4 million acre-feet in 1975.

Municipal water supply is another important consideration, especially along Colorado's front range. A number of diversions from the Colorado River Basin supplement Platte River Basin sources.

Water quality in the subbasin's streams and underground aquifers is generally good. Seasonal degradation of some watercourses is caused by runoff from agricultural lands.

Use of water from the subbasin's major streams is subject to interstate compacts or court decrees. A court decree involving the waters of the Laramie River limits Colorado's aggregate diversions and assures flows into Wyoming. The North Platte River is apportioned by decree among Colorado, Wyoming, and Nebraska. The South Platte interstate compact calls for minimum flows at the Colorado-Nebraska State line. Finally, the Upper Niobrara River Compact allocates Niobrara River streamflow and related ground water between Wyoming and Nebraska.

The subbasin States for the most part adhere to the system of prior appropriation in determining water allocation for beneficial uses. Beneficial uses are specifically defined and generally include domestic, municipal, and agriculture. Colorado further recognizes water use for instream flows for fisheries habitat and recreation, and will issue water rights for such reservations.

Management of ground water in Nebraska is limited to the creation of optional water management districts in areas of critical concern. Colorado apportions ground water in a manner similar to surface waters, requiring the granting of a water right by the State regulatory agency.

PROBLEMS AND OPPORTUNITIES

The major water related problems in the Platte-Niobrara Subbasin are irrigation water supply, flooding, municipal water supply, and fish and wildlife habitat.

Irrigation water problems involve declining ground water tables, surface water shortages, and limited opportunities for increased development.

Ground water levels are declining in localized areas in the central Platte valley in Nebraska; Alliance, Nebraska area; areas of intense irrigation in the lower Niobrara River basin; and portions of the Ogallala aquifer in Colorado. Regulatory measures to stem the declines have not succeeded to date.

Surface water shortages occur most frequently in the South Platte basin in Colorado and Nebraska and the North Platte drainage throughout Wyoming and into western Nebraska. Additional storage, system rehabilitation, and improved water management are needed to reduce annual and seasonal shortages.

Opportunities exist for irrigating additional lands in the Loup, upper Elkhorn, and Niobrara basins, and areas on the high plains separating the North and South Platte Rivers. Water availability, cost, and other factors limit development.

A considerable amount of the subbasin's lands are subject to flooding. Severe and recurring urban flooding occurs at communities with flood plain areas adjoining the basin's major streams and tributaries. These include, but are not limited to, the South Platte River and tributaries along Colorado's front range; the North Platte River from Casper, Wyoming to Glendo Reservoir; the lower Loup River Basin near Columbus, Nebraska; the middle and lower Platte River in Nebraska; and the lower Elkhorn River Basin in Nebraska. Ice jams further aggravate spring flooding upstream from the confluence of the Platte and Elkhorn Rivers in eastern Nebraska.

Rural flooding is also widespread in the Platte-Niobrara Subbasin. Flash floods caused by summer thunderstorms occasionally flood agricultural lands on the eastern plains in Wyoming and Colorado, often damaging irrigation systems. The North Platte and South Platte Rivers and their tributaries are subject to frequent spring floods which damage rural lands, farmsteads, and utilities. The steeper sloped tributaries rapidly carry excess flows to the rivers, often causing overbank flooding.

The most significant municipal water supply problems exist in Colorado's front range, including the Denver metropolitan area. Water available from the South Platte River Basin is limited and additional transbasin diversions from the Colorado River are becoming more difficult and expensive to implement.

Poor ground water quality and unreliable supplies create problems for some rural residents dependent upon underground reserves. Localized problems of this type occur in the South Platte basin, eastern Nebraska, the lower Niobrara basin, and in parts of eastern Wyoming.

Preservation of suitable habitat for fish and wildlife is a major concern in the Platte-Niobrara Subbasin. A portion of the Platte River valley in central Nebraska serves as an important stopover point for many species of migratory waterfowl, including the endangered whooping crane. Possible changes in stream regimen caused by depletions and reservoir operations are being investigated to determine waterfowl needs.

A related problem for waterfowl is drainage of wetland habitat for conversion to farmland. Declining water tables caused by pumping also have negative effects on the occurrence and quality of wetlands.

Fisheries in the subbasin are sometimes degraded due to low flows caused by extended droughts, subnormal snowpack, land treatment measures, and depletions for other uses. In the North Platte River, the annual "silt run" at Guernsey Reservoir may affect the fishery. Each year, flushing the reservoir serves to evacuate sediment accumulation and seal irrigation canals in Wyoming and Nebraska.

PLANNING OBJECTIVES

The three subbasin States differ in their views of comprehensive water planning and in the preparation of a State water plan. Colorado has completed two of three phases of a traditional State water plan, a resource inventory and legal framework, both done in cooperation with the Water and Power Resources Service. The State's near term objective is to prepare phase III, the water resources management plan.

Nebraska has abandoned the concept of a State framework plan in favor of a recently legislated State water planning and review process. The process is intended to be issue oriented with the near term objective of providing the basis for wise legislative decisions concerning the State's water resources.

Wyoming's water plan will give consideration principally to identifying of multipurpose projects to facilitate the most beneficial utilization of the resources.

It is an objective of all three States to promote the development of irrigated agriculture. Each recognizes irrigation as a high priority beneficial use of water necessary for the State's economy. A specific objective of Colorado is to provide additional storage for irrigation water on the South Platte River and its tributaries and to promote system rehabilitation and other water conservation measures. Further, Colorado opposes the conversion of prime agricultural lands and water suitable for irrigated agriculture to other uses. In Nebraska, the use of water for irrigation has been declared "a natural want" in the State statutes, underscoring the State's support for continuous irrigation development. Wyoming's objective is to maintain at

least the current level of irrigated agriculture, improve water supplies, and develop additional feasible projects.

Each of the three States desires to reduce damages caused by floods through a combination of structural and nonstructural measures.

Although it is an objective of each State to preserve fish and wildlife resources and habitat, only Colorado officially recognizes the maintenance of instream flows for habitat as a beneficial use. Wyoming specifically calls for fish and wildlife resources to be considered in all planning processes.

The three States desire to provide increased quantity and improved quality of municipal, industrial, and rural domestic water. Colorado objectives call for cooperation between Federal, State, and local entities to provide for the water supply needs. The State specifically promotes employment of water conservation measures to reduce per capita use in municipal systems. A sound State plan for development of storage, distribution, and conservation of water supplies is an objective of the State of Wyoming.

State objectives concerning the preservation of natural, historic, and cultural resources differ slightly among the Platte-Niobrara Subbasin States. Colorado calls for an identification of significant natural areas, studies of riparian habitat, and an updated wetlands inventory leading to restoration of certain wetlands. Nebraska objectives call for investigations of potential protected streams in upcoming policy issues analyses. Wyoming desires to inventory and classify the State's natural, historic, and cultural resources.

Each of the States wants to provide improved water based outdoor recreation for its citizens. A goal in Colorado is to expand recreational use of private and public water bodies. The State calls for operational studies to improve recreation opportunities and for local entities to work toward providing recreational access to private reservoirs. Wyoming objectives seek to provide recreational opportunities for the expanding populations resulting from energy development. The State calls for expansion of existing facilities and development of new recreation areas. Nebraska encourages local political subdivisions to provide recreational opportunities.

PLAN OVERVIEW

The plan for the Platte-Niobrara Subbasin includes the programs and conclusions and additional recommendations in this chapter, the basinwide recommended programs listed in chapter 2, and the statewide programs recommended for Colorado, Wyoming, and Nebraska also contained in chapter 2. Many of the plan elements for the Platte-Niobrara Subbasin were originally recommended in the Commission's Platte River Basin, Nebraska, Level B Study, completed in 1976.

An element of the recommended plan is Department of the Interior's "Platte River Studies." The analysis is being conducted in three parts, an hydrology study, an ecology study, and an operations study, by the Geological Survey, Fish and Wildlife Service, and Water and Power Resources Service, respectively. Results of the studies should provide information needed to resolve a number of problems involving the future management of the Platte River.

In the area of comprehensive planning, the recommended plan calls for the Water and Power Resources Service to assist the State of Colorado beginning in FY 1982 in completing its State water plan.

The plan emphasizes the effort of several agencies to deal with the subbasin's identified urban and rural flooding problems. In the densely populated Denver metropolitan area, it is recommended that the Urban Drainage and Flood Control District continue its programs to delineate flood hazards and to plan for and construct measures to control them. The District is further called upon to cooperate with the Corps of Engineers to construct flood control measures at Westerly Creek near Denver. The plan also recommends that the Corps complete channel improvements on the South Platte River below Chatfield Dam.

The plan recommends local flood control projects by the Corps at chronic flood prone areas in Nebraska that include Pender, and Columbus.

To help control flooding in upstream watershed areas, the plan calls for 30 Soil Conservation Service watershed projects. Eight projects are in Colorado; 20 in Nebraska; and two in Wyoming.

Development of additional irrigated acreage is the focus of several recommended plan elements. The plan calls for the Water

and Power Resources Service to proceed with three major multipurpose projects, North Loup and O'Neill Units in Nebraska and the Narrows Unit in Colorado. Feasibility or appraisal studies are recommended for three other projects in the subbasin. Also, rehabilitation and betterment is recommended for the existing North Platte Project.

The Soil Conservation Service is called upon to implement seven irrigation oriented watershed projects and to conduct irrigation water conservation studies in Colorado and Wyoming.

To address the serious problem of water supply for the Denver area, the subbasin plan recommends construction of the Foothills Project, which includes a storage reservoir on the South Platte River, a treatment plant, and related distribution facilities. The subbasin's rural water supply problems are addressed by the basinwide recommended program "Water Supply and Waste Water Disposal Systems" of the Farmers Home Administration.

Finally, the recommended plan contains a number of proposals intended to increase the production of electric power for use within and outside the subbasin. One plan element is construction by the Central Nebraska Public Power and Irrigation District of a hydroelectric plant at Kingsley Dam on the North Platte River in Nebraska. Feasibility studies are called for by the Water and Power Resources Service to investigate installation of hydroelectric facilities at the Colorado/Big Thompson Project and in the Cache la Poudre River Basin. It is also recommended that water and power conduct the "North Platte Hydroelectric Study" in Wyoming, to look at pumped storage opportunities at the existing reservoirs. Finally, the plan calls for integration of wind turbine electric power generation into the existing hydroelectric system.

RECOMMENDED PROGRAMS - PLATTE-NIOBRARA

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-UPPER PLATTE RIVER STUDIES DOI/Water and Power Resources Service Comprehensive	Ongoing three-part special study of issues on the Platte River drainage above Columbus, Neb; FWS--ecology study; GS--hydrology study; WPRS--operations study; coor. by DOI & MRBC; cost $2.3 mil.
2-COLORADO STATE WATER PLAN, PHASE III DOI/Water and Power Resources Service Comprehensive Also in Kansas Subbasin	Proposed new start studies to prepare the phase III development plan; cost estimated at $570,000 in FY 83; $290,000 in FY 84; Colorado State agencies will participate.
3-EAST CENTRAL COLORADO RC&D AREA, COLORADO USDA/Soil Conservation Service Comprehensive Also in Kansas Subbasin	Ongoing feasibility study in Elbert, Lincoln, Kit Carson, Cheyenne counties; annual funding requirements are $70,000 through FY 82.
4-OVERLAND TRAILS RC&D AREA, COLORADO USDA/Soil Conservation Service Comprehensive Also in Kansas Subbasin	Proposed FY 81 feasibility study in Logan, Morgan, Sedgwick, Phillips, Washington, and Yuma counties; annual funding requirements are $70,000.
5-PANHANDLE RC&D AREA, NEBRASKA USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study in 11 northwestern counties; annual funding requirements are approximately $500,000.
6-NORTH-CENTRAL RC&D AREA, NEBRASKA USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study in six counties in Nebraska's sandhills; annual funding requirements are approximately $500,000.

7-SOUTHEASTERN WYOMING RC&D AREA, WYOMING USDA Soil Conservation Service Comprehensive	Ongoing feasibility study in Laramie, Platte, Goshen, and Converse counties; funding requirements are $51,000 for FY 80; $100,000 for FY 81-82.
8-NEBRASKA RIVER BASINS SPECIAL STUDIES USDA Soil Conservation Service Comprehensive Also in W. Dakotas, E. Dakotas, & Middle Mo. Subbasins	Ongoing special studies of erosion, sediment, rural water, & flooding in Mo. tribs & White-Hat basins; prime farmland mapping in Platte critical habitat areas. Cost is $1.3 million; FY 79-84.
9-SNOW SURVEYS USDA Soil Conservation Service Comprehensive Also in Upper Missouri and Yellowstone Subbasins	Ongoing program of manual and remote measurement of hydrometeorological snow survey data stations in mountain snow courses in WY, CO, and MT; total FY 81 funding requirement for MRB is $328,000.
FLOODING	
10-DESIGN AND CONSTRUCTION PROGRAM, DENVER, COLORADO Urban Drainage and Flood Control District Flooding	Ongoing design and construction of flood control measures for Denver metro area; local governments are cooperating agencies; annual joint expenditures are approx. $4 million through FY 82.
11-FLOOD HAZARD AREA DELINEATION PROGRAM, DENVER, COLORADO Urban Drainage and Flood Control District Flooding	Ongoing studies to define 100-year flood plain for further management by local entities; Colo. WCB & local gov'ts contribute; annual requirements are $95,000 through FY 82.
12-MASTER PLANNING PROGRAM, DENVER, COLORADO Urban Drainage and Flood Control District Flooding	Ongoing studies on major drainageways in Denver area to define flood plain, estimate anticipated damages, evaluate alternatives, & select flood control designs; annual costs are $235,000 thru FY 82.
13-DOWNSTREAM CHANNEL IMPROVEMENT AT CHATFIELD DAM, COLORADO Army Corps of Engineers Flooding, Recreation	Proposed new start implementation of flood control and erosion control measures on the S. Platte River channel from Chatfield Dam down to Denver; schedule is not yet determined; cost $9.9 million.

14-METROPOLITAN DENVER AND SOUTH PLATTE RIVER BASIN, COLORADO Army Corps of Engineers Flooding	Proposed construction of flood controls measures on Westerly Creek in Denver; authorization is pending; includes 1 new dam, channel mod., and dam mod.; Federal and local costs total $18 million.
15-LOGAN CREEK LOCAL FLOOD CONTROL PROJECT, PENDER, NEBRASKA Army Corps of Engineers Flooding, Recreation	Proposed construction of levee and recreation lake at Pender, Neb.; Local sponsors currently acquiring right-of-ways; construction to begin FY 81; total cost $3.1 million; Federal share $2.5 million.
16-LOST CREEK LOCAL FLOOD CONTROL PROJECT, COLUMBUS, NEBRASKA Army Corps of Engineers Flooding	Resumption of work on detailed project report for flood protection at Columbus, Neb.; studies should be completed FY 81, when construction of Lost Creek diversion should begin; cost $180,000 for study.
17-BOULDER VALLEY WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Flooding	Watershed project on St. Vrain Creek, Boulder County; includes 5 flood protection dams and 5 miles of floodway.
18-COAL CREEK WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Flooding	Watershed project recommended for planning in Jefferson County; includes 5 miles of floodway; construction cost estimated to be $200,000.
19-EAST BIJOU WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Flooding and Land Conservation and Management	Watershed project recommended for planning in Elbert and Arapahoe counties; will include land treatment; total cost $1 million.
20-EAST PLUM WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Flooding	Watershed project on Plum Creek in Douglas County; includes six flood protection dams.

21-EVANS WATERSHED PROJECT, COLORADO USDA Soil Conservation Service Flooding	Watershed project in Weld County; includes one flood protection dam.
22-PLUM CREEK WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Flooding	Watershed project in El Paso, Douglas, and Teller counties; includes eight flood protection dams.
23-OGALLALA WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding	Watershed project with approved application planning authorization expected FY 84; located in Keith County; includes two flood retention structures; total cost estimated at $100,000.
24-BUFFALO-ELM WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding	Watershed project with approved application; planning authorization expected FY 84; located in Custer, Dawson, & Buffalo counties; includes 7 flood retention structures; total cost $2 million.
25-WAHOO CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding	Watershed project with approved application; planning authorization expected FY 85; located in Saunders County; includes 13 flood retention structures; total cost $5 million.
26-UPPER PRAIRIE CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding	Watershed project with approved application; planning authorization expected FY 86; located in Buffalo and Hall counties; includes 6 flood retention structures; total cost estimate $1.5 million.
27-SKULL CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding and Land Conservation and Management	Watershed project with approved application; planning authorization expected FY 85; located in Butler County; includes 20 grade stabilization structures; cost estimated to be $1.5 million.

28-SOUTHERN SARPY WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding and Land Conservation and Management	Watershed project with approved application; planning authorization expected FY 83; located in Sarpy County; includes 36 grade stabilization structures; cost estimated to be $2 million.
29-NORTH BRANCH WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding	Watershed project with approved application; planning authorization expected FY 85; located in Buffalo and Hall counties; includes 28 miles of channel; 217 miles of laterals; cost $4 million.
30-WARM SLOUGH/SILVER CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding	Watershed project with approved application; planning authorization expected FY 85; located in Hall and Merrick counties; includes 45 miles of channel; 251 miles of laterals; cost $4 million.
31-ROCK CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding and Fish and Wildlife	Watershed project with approved application; planning authorization expected FY 80; located in Saunders & Lancaster Co.; includes 9 floodwater retention & 1 fish & wildlife struc.; cost $6 million.
32-NORTHEAST CASS WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding and Land Conservation and Management	Watershed project with approved application; planning authorization expected FY 82; located in Cass County; includes 43 grade stabilization structures; cost is estimated at $2.5 million.
33-STEVENS-CALLAHAN WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Fish and Wildlife, and Recreation	Active planning underway; expected approval for operation FY 81; located in Lancaster, Saunders, and Cass counties; includes two multipurpose & one flood retention structure; cost is $3.5 million.
34-BONE CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Fish and Wildlife, and Recreation	Active planning underway; expected approval for operation FY 82; located in Butler County; includes one multipurpose and five flood retention structures; cost estimate is $1 million.

35-MAPLE CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding, F&W, Rec., and Land Cons. Mgmt.	Active planning underway; expected approval for operation FY 81; located in Stanton, Colfax, and Dodge counties; includes 13 grade stab., 25 flood, and 3 multipurpose structures; cost $5.5 million.
36-DOUGLAS WATERSHED PROJECT, WYOMING USDA Soil Conservation Service Flooding, and Land Conservation and Management	Active planning underway; expected approval for operation after FY 79; located in Converse County; includes three flood retention structures, pipelines, channel, and land treatment; cost $2.1 million.
37-BOX ELDER WATERSHED PROJECT, COLORADO USDA Soil Conservation Service Flooding, and Land Conservation and Management	Project under construction; completion scheduled FY 81; located in NE Colo. and SE Wyo. in the Cache la Poudre Basin; includes one grade stab. & five flood protection dams; cost is $6.7 million.
38-SEDGWICK-SAND DRAWS WATERSHED PROJECT, COLORADO USDA Soil Conservation Service Flooding	Project under construction; completion scheduled FY 85; located in NE Colo, S. Platte River Basin; includes 3 miles of floodway and 10 flood protection dams; cost will be $7 million.
39-BELLWOOD WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding	Project under construction; completion scheduled FY 86; located in Butler County; includes 14 flood retention structures, 15 miles of channel; cost is estimated to be $2.3 million.
40-CLEAR CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding, and Land Conservation and Management	Project under construction; completion scheduled FY 84; located in Saunders County; includes 3.5 miles channel; one grade stab. and 3 flood retention structures; cost will be $1.2 million.
41-COTTONWOOD WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding, and Land Conservation and Management	Project under construction; completion scheduled FY 84; located in Saunders County; includes 12 flood retention structures; cost estimated at $2.3 million.

42-GERING VALLEY WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding	Project under construction; completion scheduled FY 86; located in Scotts Bluff County; includes 9 flood retention structures; 22 miles of channel; cost is $6.7 million.
43-OAK/MIDDLE & NORTH OAK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Cons. & Mgmt., Recreation	Project under construction; completion scheduled FY 84; located in upper Salt Creek Basin; includes 9 flood retention structures; 22 miles of channel; cost is $6.7 million.
44-SPRING CREEK (DAWSON COUNTY) WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding	Project under construction; completion scheduled FY 81; located in Dawson and Custer counties; includes 6 flood retention structures; cost is estimated at $2.7 million.
45-WINTER'S CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding	Project under construction; completion scheduled FY 80; located in western Neb, in N. Platte Basin; includes 1 flood retention structure; 7.2 miles of channel; cost estimated at $4 million.
46-SPRING CANYON WATERSHED PROJECT, WYOMING USDA/Soil Conservation Service Flooding, and Land Conservation and Management	Project under construction; completion scheduled FY 82; located in Goshen County, N. Platte Basin; includes one flood retention structure, pipeline, and land treatment; cost is $1.1 million.
FISH AND WILDLIFE	
IRRIGATION	
47-COOPERATIVE IRRIGATION WATER CONSERVATION STUDY, WYOMING USDA/Soil Conservation Service Irrigation Also in Yellowstone and Western Dakotas Subbasins	FY 80 new start special study of irrigation water conservation throughout Wyoming; scheduled for effort by SCS, FS, and ESCS through FY 85; total cost $1.1 million.

48-SOUTH PLATTE RIVER BASIN COOPERATIVE STUDY, COLORADO USDA Soil Conservation Service Irrigation, M&I and Rural Supply, Land Conserv. & Mgmt.	Proposed FY 81 new start regional study of irrig. water mgmt., rural water supply, and erosion in the S. Platte Basin; SCS, FS and ESCS effort scheduled FY 81-84; total cost $850,000.
49-FARWELL UNIT WATER CONSERVATION STUDY, NEBRASKA DOI Water and Power Resources Service Irrigation, Water Quality, Land Conserv. & Mgmt.	FY 80 new start study of water use and rising ground water table problems in Nebraska's Middle Loup River Basin; total funding requirement is $350,000 for FY 80-82.
50-NARROWS UNIT, COLORADO DOI Water and Power Resources Service Irrigation, Recreation, Flooding, F&W, Transportation	Authorized project for irrigating 287,000 acres in S. Platte Basin; construction funds deferred pending alternatives analysis in FY 80; total project cost is $169 million.
51-NORTH LOUP DIVISION, NEBRASKA DOI Water and Power Resources Service Irrigation, Recreation; Nat., Hist. & Cult., Rec., F&W	Ongoing construction of project to irrigate 53,000 acres in central Neb.; completion scheduled post-FY 85; total cost estimated to be $160 million.
52-O'NEILL UNIT, NEBRASKA DOI Water and Power Resources Service Irrig.; F&W; Recreation; Nat., Hist., & Cult.; Flooding	Ongoing project for irrigation of 77,000 acres in north-central Neb.; construction is enjoined pending supplementing the EIS; includes Norden Dam on Niobrara R; cost estimated to be $226 million.
53-NORTH PLATTE PROJECT, REHAB. AND BETTERMENT, NEB. & WYO. DOI Water and Power Resources Service Irrigation, Fish & Wildlife	Ongoing special study of the Guernsey Res. silt run and alternatives for improving irrigation efficiency on N. Platte project systems; study cost estimated at $936,000 through FY 83.
54-PRAIRIE BEND UNIT FEASIBILITY STUDY, NEBRASKA DOI Water and Power Resources Service Irrigation, Fish & Wildlife, Water Quality, Instream Flows	Proposed feasibility study to begin in FY 82 for irrigation project on 70,000 acres in central Platte River area; will include study of conjunctive use and wildlife habitat; cost $1.6 million.

55-SPARKS UNIT APPRAISAL STUDY, NEBRASKA DOI/Water and Power Resources Service Irrigation, Instream Flows, Fish & Wildlife, Recreation	Ongoing regional appraisal of potential for irrigating 35,000 acres in northern Neb. using the Niobrara River; completion scheduled FY 81; cost is $355,000.
56-LITTLE BLUE WATER RESOURCES PROJECT STUDY, NEBRASKA Little Blue Natural Resources District Irrigation Also in Kansas Subbasin	Proposed feasibility study for a project to divert 115,000 AF of Platte River flows to storage and delivery system in the L. Blue basin to irrigate 40-60,000 acres; study cost $240,000 over 5 years.
57-HENRYLYN WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Irrigation	Watershed project with approved application; located in Adams and Weld counties; planned improvement of 20 miles of irrigation canals; cost estimated at $5 million.
58-LEFT HAND DITCH WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Irrigation	Watershed project with approved application; located in Boulder Co.; St. Vrain Creek; includes 5 miles of irrigation canal improvement; cost estimated to be $1 million.
59-WESTERN CANAL WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Irrigation	Watershed project located in Weld County; Cache la Poudre River basin.
60-LAPRELE WATERSHED PROJECT, WYOMING USDA/Soil Conservation Service Irrigation	Watershed project with approved application. Rehabilitation of existing irrigation distribution system and land treatment. Located in Converse County; N. Platte River basin.
61-CORN CREEK IRRIGATION PROJECT, WYOMING Corn Creek Irrigation District and State of Wyoming Irrigation	Further planning may be conducted to determine project feasibility using State and local funds; irrigation project in Goshen and Platte Counties; water would be pumped from North Platte River near junction with Laramie River.

62-HOME SUPPLY WATERSHED PROJECT, COLORADO USDA/Soil Conservation Service Irrigation	Project under construction, to be completed FY 81; located near S. Platte in Laramie and Weld counties; includes ditch lining, siphons, and water supply reservoirs; cost is $4.3 million.
63-UPPER NORTH LARAMIE WATERSHED PROJECT, WYOMING USDA/Soil Conservation Service Irrigation, Recreation, and Land Conservation and Mgmt.	Project under construction, to be completed FY 85; located in Albany County; will include a multi-purpose reservoir, recreation facilities, and land treatment; cost estimated at $1.4 million.
MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY	
64-FOOTHILLS MUNICIPAL WATER TREATMENT PLANT & REL. FACILITIES Denver Board of Water Commissioners M&I Supply	Ongoing construction of municipal water supply treatment and conveyance facilities to serve Denver area; plant will use S. Platte River water stored at Strontia Springs Dam; cost $150 million.
NATURAL, HISTORIC, AND CULTURAL RESOURCES	
POWER AND ENERGY	
65-WIND-HYDROELECTRIC ENERGY INTEGRATION STUDIES DOI/Water and Power Resources Service Power & Energy	Ongoing special studies of feasibility to integrate wind turbine generators with existing hydroelectric system; pilot project near Medicine Bow, Wyo.; study costs are $13.1 million; FY 78-83.
66-NORTH PLATTE HYDROELECTRIC STUDY, WYOMING DOI/Water and Power Resources Service Power & Energy	Proposed study to begin in FY 82 of the feasibility of large-scale pumped storage hydro units at existing N. Platte River reservoirs in Wyoming; estimated cost is $1.1 million over 4 years.

67-COLORADO/BIG THOMPSON HYDROELECTRIC STUDY
DOI/Water and Power Resources Service
Power and Energy

Proposed study to begin in FY 82 of the feasibility of additional hydroelectric facilities for the Big Thompson Project; includes Pinewood-Carter pumped storage unit; study costs estimated at $900,000.

68-CACHE LA POUDRE HYDROELECTRIC FEASIBILITY STUDY, COLORADO
DOI/Water and Power Resources Service
Power and Energy

Proposed study of the feasibility of developing hydroelectric generating facilities in the Cache La Poudre River Basin.

69-KINGSLEY HYDROELECTRIC PROJECT, NEBRASKA
Central Nebraska Public Power & Irrigation District
Power and Energy

Proposed construction of 50 mw hydroelectric plant at existing Kingsley Dam on the N. Platte River; application has been submitted to FERC; cost estimate is $60 million; construction over 3.5 yrs.

WATER-ASSOCIATED OUTDOOR RECREATION

70-DENVER-SOUTH PLATTE RIVER DEVELOPMENT, COLORADO
City of Denver
Recreation

Ongoing planning and development of recreation facilities along the S. Platte River corridor in Denver; H.C.R.S. is cooperating agency; costs are $5 million in FY 81 and again in FY 82.

TRANSPORTATION

WATER QUALITY

LEGAL AND INSTITUTIONAL

INSTREAM FLOWS

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. The State of Colorado, in cooperation with the Water and Power Resources Service, has completed two phases of its State water plan, a legal framework and a resource inventory. The State needs to develop the water resources management plan. It is recommended that the Water and Power Resources Service accelerate its schedule for assisting the State of Colorado in preparing the State water plan.

B. Studies indicate that no reliable source of water is available for irrigating high quality lands along the Cedar River and Loup River in Nebraska. A feasibility study for a multipurpose Federal project has been terminated. It is recommended that the Water and Power Resources Service conduct a broad water management study for parts of the Loup River Basin which includes the Cedar River drainage.

C. The recommended plan elements contained in the Missouri River Basin Commission's "Platte River Basin, Nebraska, Level B Study" were adopted in 1976 to constitute the approved regional plan for the area studied. All of those recommendations were reconsidered during the current update and preparation of the recommended plan for the Platte-Niobrara Subbasin. Several of the level B recommendations have been completed; most of the remainder have been incorporated in the current recommended plan elements or have been deferred from further consideration. A number of other Platte level B plan elements continue to be recommended including:

Recommended legislative and institutional policy actions:

Enact Nebraska Environmental Policy Act
Implement Land Use Planning and Management Program
Mitigate Fish, Wildlife, and Environmental Damages
Regulate Channel Alterations
Manage Public School Land and Right-of-Way for Wildlife Habitat
Expand Monetary Incentive Programs for Wildlife Habitat
Expand Environmental Education and Research Programs
Expand Wetland Acquisition and Restoration Program
Revise Federal Flood Control and Recreation Project Acts (P.L. 83-566 and P.L. 89-72)

Amend Nebraska Flood Plain Management Act
Establish Protected Stream System
Implement Ground Water Quality Management Program
Accelerate Land Conservation Measures

Fencing and bank stabilization of trout streams: Nine Mile Creek, Red Willow Creek, Tub Springs, Wild Horse Creek, and Winters Creek in western Nebraska.

Development of flood plain municipal parks:

Arlington	Albion	Bridgeport	Ashland
Clearwater	Broken Bow	Cairo	Ceresco
Lyons	Dannebrog	Central City	Columbus
Nickerson	Genoa	Cozad	Denton
Oakdale	Loup City	Gibbon	Eagle
Pender	Pleasanton	Grand Island	Fremont
Pilger	Spalding	Kearney	Greenwood
Scribner	St. Edward	North Platte	Gretna
Stanton	St. Paul	Ogallala	Lincoln
Winslow	Scottsbluff	Lindsay	Manley
Terrytown	Wood River	Pleasant Dale	
Springfield	Wahoo	Yutan	

Development of river access and recreation facilities:

Neligh to Mouth Elkhorn R., 170 mi., 7 locations
Upper reaches, Dismal, Middle Loup, North Loup, Calamus, and Cedar Rivers, 540 mi., 29 locations
North Platte and Main Platte Rivers, Scottsbluff to Central City, 7 locations
Platte River, Columbus to mouth, 100 mi., 6 locations

Sandpit lakes recreation developments:

Elkhorn River, Battle Creek to Platte River, 7 locations
Loup, North Loup, Middle Loup Rivers, 5 locations
Platte River, Grand Island to Scottsbluff, 4 locations
Platte River, Gretna to Schuyler, 4 locations

Regional park development at Willow Creek, near Pierce, Nebraska

CHAPTER 8

MIDDLE MISSOURI SUBBASIN

SUBBASIN DESCRIPTION

The Middle Missouri Subbasin covers an area of 14.8 million acres in the east-central portion of the Missouri River Basin. As shown in figure 11, it includes lands drained by all of the direct tributaries of the Missouri River from Sioux City, Iowa, to Kansas City, Missouri, except Nebraska's Platte River. Principal among these are the Little Sioux River draining the northern portion southwestward, the Nishnabotna River flowing southward from the center of the subbasin, and the Nemaha River flowing southward along the eastern boundary.

The topography in general is a rolling, irregular plain. Along the main stem of the Missouri River and its principal tributaries are flat bottomlands with bluffs often having several hundred feet of local relief. The elevation of the Missouri River varies from 1,220 feet (mean sea level) at Sioux City, Iowa, to 750 feet at Kansas City, Missouri. The subbasin drains generally north to south and extends about 325 miles north-south, and 175 miles east-west.

Average annual precipitation varies from 26 inches in the northwest to 36 inches in the south but annual precipitation often varies greatly from those averages. July is normally the subbasin's warmest month and January the coldest. Mean daily maximum temperatures in January range from 26 degrees in the north to 40 degrees in the south, and in July, range from 86 to 92 degrees. The average freeze-free period varies from approximately 150 days in the north to over 180 days in the extreme south.

Figure 11 – Middle Missouri Subbasin

Although most lands in this subbasin have been either agriculturally or industrially developed, native ecosystems such as eastern deciduous forests or grasslands persist in areas where dominant natural features have inhibited development. However, most of these lands are in private ownership and survival is uncertain.

Eastern deciduous forests and flood plain forests are extensive along the Missouri River and, to a lesser extent, along some of the major tributaries. The Loess Hills region of Iowa contains the greatest acreage of eastern deciduous forest. In other scattered areas, particularly in northwestern Missouri, southeastern Nebraska, and northeastern Kansas, relics of the former oak-hickory-prairie savanna occur in upland regions several miles from the river bottoms.

Forested lands occupy less than 5 percent of the total subbasin landscape but provide a large portion of the habitat base for deer, quail, squirrel, cottontail, and wild turkey. They are also the last refuges for regionally threatened, rare, or declining fauna such as the woodchuck, southern flying squirrel, whippoorwill, pileated woodpecker, several species of warblers, several raptors, and several reptiles and amphibians. Several species of plants also depend upon the hardwood forest for survival.

Widely scattered relics of the tallgrass prairie ecosystem persist in the upper reaches of the Little Sioux River, including the prairie lakes region in Iowa, and along the Loess Bluffs of the Missouri River. These lands support much of the original native prairie flora and fauna including many species which are naturally rare or are regionally declining. Examples include the northern greater prairie chicken (Nebraska and Kansas only), white-tailed jackrabbit (extinct in Kansas), spotted skunk, Franklin ground squirrel, prairie falcon, and certain reptiles. Populations of the endangered white lady-slipper, an orchid, may persist in certain remote areas. Certain agricultural regions, especially where good interspersion of land uses occur, afford excellent upland habitat and provide key habitat for wildlife.

Aquatic resources, although limited both in diversity and quantity, include natural prairie lakes and prairie potholes of Iowa, the farm ponds and small reservoirs throughout the subbasin, free flowing reaches of the Missouri River, major tributary streams, and various stream related ponds and wetlands.

Fishery resources are of variable quality. Good fisheries occur in some of the natural glacial lakes of Iowa, in certain small farm ponds and small reservoirs, and in some oxbow lakes along the Missouri River. Populations of fishes in most streams are dominated by rough fish, but in some reaches channel catfish can be harvested. Certain rare, threatened, or endangered fish persist in the Missouri River, including the unique paddlefish, the lake pallid and shovelnose sturgeons, and several native forage species.

Waterfowl habitat is even more limited and is largely confined to the natural wetlands region in Iowa. Existing water resources including oxbow lakes, ponds, and reservoirs along the Missouri River are used heavily by waterfowl during migration. Such resources in the southern portion of the subbasin provide a wintering range. Large geese populations and small numbers of the nothern bald eagle are also common around Federal wildlife refuges during winter.

The Missouri River corridor, especially the bluffs, forests, islands, and oxbow lakes, contribute much to the diverse landscape quality of this region. The corridor is nationally significant as part of the Lewis and Clark National Historic Trail. The Loess Bluffs and prairie lakes landscapes in Iowa and the Nemaha, Nishnabotna, and Little Sioux bottomland forests are also significant natural and aesthetic resource areas.

The subbasin contained the basin's third largest population in 1975. Future projections indicate the total subbasin population should continue to grow and reach approximately 1.65 million persons, an increase of 25 percent, by the year 2000.

Three Standard Metropolitan Statistical Areas with a combined 1975 population of 792,800, are located within the Middle Missouri Subbasin. The three, Omaha, Nebraska-Iowa (572,900), Sioux City, Iowa-Nebraska (120,000), and St. Joseph, Missouri (99,700), collectively constitute 60 percent of the total subbasin population, and 86 percent of its total urban population.

Approximately 2,200 native American Indians live in the subbasin. Highly variable out migration and return migration rates among Indians complicate accurate estimates of demographic data for this group.

In 1975, about 36 percent of the total population or 471,000 persons were employed. Of this total, only 12 percent or 56,200 persons was engaged in agriculture. This figure has continually declined over the last few decades. Employment in nonagricultural economic pursuits has, however, enjoyed a continued rise. Approximately 415,000 persons, or 88 percent of the work force are employed in nonagricultural sectors. Total employment is projected to reach 586,900 persons, an increase of 25 percent over the 1975 level, by the year 2000.

Agriculture is the dominant land use in the subbasin but the major use of water is for thermal electric power generation. Other major water uses include municipal and industrial and irrigation.

Depletions to streamflow within the subbasin are relatively low, totaling only 232,000 acre-feet in 1975. This level is expected to increase to 430,000 acre-feet by the year 2000. However, withdrawals total nearly 10 times depletions due to large diversion for once through cooling at several steam electric plants located along the Missouri River.

The 1975 average annual outflow from the subbasin, measured at Kansas City, Missouri, was estimated to be about 28 million acre-feet. Remaining flows are projected to decline by some 3.2 million acre-feet by 1985 and by another 3.7 million by the year 2000.

Most of the streams within the subbasin are comparatively small, and seasonal water shortages are common. Because the streams drain primarily agricultural areas, runoff causes high concentrations of nitrates, phosphates, and insecticides. Normally, concentrations of inorganic salts are low.

Most streams carry heavy loads of suspended sediment. Turbidity is high most of the time. All have experienced undesirably low levels of dissolved oxygen due to inadequately treated waste waters, low flows, and warm water temperatures. Low dissolved oxygen levels also occur after heavy runoff because of high turbidity.

The States of the Middle Missouri Subbasin govern the use of water through several different legal systems. Minnesota and Missouri recognize the riparian doctrine. Kansas and Nebraska depend upon prior appropriation systems but acknowledge riparian

doctrine in varying degrees. Iowa makes substantially all uses of water subject to permit and administrative regulations governing diversion, storage, and withdrawal over a period of time not exceeding 10 years.

PROBLEMS AND OPPORTUNITIES

Nonpoint source pollution is the major water resources problem in the Middle Missouri Subbasin. Other major problems include flooding along many of the tributary streams, consumptive use and diversion by upstream States which decreases the amount of water available for downstream use, drinking water of poor or unacceptable quality, oxbow lake elimination and channel straightening, and demand for water access and recreational facilities.

Steep slopes and soil types in Iowa and northwest Missouri cause severe gully erosion. Streambank erosion is a principal problem in the Nemaha Basin in Nebraska, and in the Nishnabotna and Nodaway Basins in Iowa. Nebraska counties between South Sioux City and Omaha have the highest soil loss in the State. In some areas in northwest Missouri, the problem has evolved a full cycle. The natural winding streams were straightened and channelized some 30 to 40 years ago; severe streambank erosion has since occurred, and the streams have returned to the natural course.

Flooding problems in this subbasin have many aspects. Flooding is still a problem along several tributary streams in the Middle Missouri Basin. In many of the smaller communities, there is at present no feasible and acceptable structural solution. Problems in a number of smaller communities have been studied in the past by various State and Federal agencies. Potential structural solutions have not been found to be economically acceptable in most instances, and suggested alternatives have not generally been accepted by local people. Even though levees have been constructed along the Missouri River, flooding continues to be a problem in Nebraska downstream of the Missouri's intersection with the Platte River in Nebraska. Private levees are being moved or constructed too close to the river, infringing on the floodway and shifting flood damage to other areas. Tieback levees on some tributary streams were designed and constructed to provide 50 year protection from flooding on both the main stem and tributaries. Due to numerous factors, including aggradation of the stream beds of the tributaries, this level of protection has dropped to a 10 year or 25 year event.

The energy crisis has spotlighted the fact that projected power demands nationally will necessitate the construction of additional power plants in the subbasin. New power plants will need to be located on the major rivers in order to permit the assimilation of discharged cooling water and to cause the least possible adverse environmental effect. Disposal of power plant cooling water into retention ponds where thermal pollution can be reduced could provide an opportunity for improved production of fish.

Drinking water quality problems occur in Otoe and Cass County, Nebraska, in the Sioux City, Iowa, area, and in southwest Iowa. Ground water has historically been the source of most of the rural domestic water in the subbasin. While the quality and quantity of these sources has generally been sufficient in the past, conflicts between rural domestic and urban water uses have begun to occur. In some rural households, drinking water does not meet standards established by the Federal Safe Drinking Water Act. This is due to the naturally poor quality of available water and to continued quality degradation from both point and nonpoint sources of pollution in the area.

Oxbow lake elimination and channel straightening on the Missouri River main stem and tributary streams are reducing and changing the fisheries habitat in the Middle Missouri Subbasin. Lost wetlands are not being replaced by maturing wetlands in these areas, and fish and wildlife are being adversely affected by man's activities, including cropping all available lands.

There is a documented demand for water access and recreational facilities in the metropolitan areas such as Sioux City, and Council Bluffs, Iowa, and St. Joseph, Missouri, and in all of southwestern Iowa. While there is some fishing on the main stem, there has been a demand for flat water or lake recreation. Population growth of the metropolitan areas in the Middle Missouri Subbasin has overtaxed existing facilities. Some work has been done to improve recreation such as the Lake Manawa Project in the Council Bluffs area, but there is a need for more active development of recreation areas, facilities, and public access.

PLANNING OBJECTIVES

Each of the five States located in the Middle Missouri

Subbasin has comprehensive planning programs for the wise and beneficial development, management, and use of water resources. Most have mechanisms to develop a State water plan, and methods for continually updating information for decisionmaking. All five States have the concrete objective to minimize or reduce flood damages and losses resulting from floods. The States of Iowa, Nebraska and Minnesota emphasize the use of nonstructural measures.

For fish and wildlife, the States have programs involving conservation and management in a general sense. The State of Iowa recognizes certain designated streams as having exceptional recreation and fish and wildlife uses, and provides for their special protection against low flows and water withdrawals. In the State of Kansas, while fish and wildlife protection is required by law, there is no State policy in effect for preserving habitat. The State does maintain a list of protected flora and fauna, however.

Irrigation objectives in the Middle Missouri Subbasin differ from State to State. The objective of Nebraska and Kansas is to develop irrigation potential and provide an adequate supply of water for irrigation. Minnesota and Iowa objectives are tempered by the qualification that water permits for irrigation should be issued on a case by case basis. Iowa encourages private funding of individual farm irrigation development, reserving the use of public funds for cases where increased food and fiber production are considered in the public interest. In Missouri, irrigation is not as commonly practiced as in the other States. The State's goal is to protect and foster development of agricultural resources, including the State's limited irrigation opportunities.

Improvement of land treatment and land conservation and management in this subbasin are clearly recognized objectives. Protection of the productivity of soils, control of erosion, and reduction of sediment loading in streams are all actively pursued. Four of the States in the subbasin have objectives of meeting the municipal, industrial, rural domestic, and livestock water quality needs wherever feasible. Nebraska and Kansas generally support all methods of providing water, especially to small communities. Iowa and Minnesota modify their support by encouraging water users to adopt water conservation measures. Missouri has an objective to implement training and technical assistance programs to assist in water conservation, and will strive to monitor the quality of finished water, review plans for

construction of water supply facilities, and inspect such facilities in an effort to maintain the purity of drinking water.

Power and energy objectives vary somewhat from State to State. Minnesota opposes actions that would severely impair hydropower generation in the Missouri River or its delivery to current Minnesota users. Location of power plants is of major concern to Iowa, Kansas, and Missouri for many reasons. Thermal and other pollution at power plant sites is basically limited to major waterways such as the Missouri River.

Transportation objectives of the subbasin States recognize the importance of Federal participation. Iowa specifically encourages the Federal Government to finance and maintain the navigation on the Missouri River.

PLAN OVERVIEW

The plan for the Middle Missouri Subbasin includes the programs recommended in this chapter, the programs recommended basinwide in chapter 2, and the statewide programs that are recommended for the five States of Minnesota, Nebraska, Iowa, Kansas, and Missouri in chapter 2.

As stated earlier, nonpoint source pollution is a major subbasin problem. An important recommendation of the Middle Missouri Subbasin plan is, therefore, to actively address agricultural runoff problems through implementation of the Rural Clean Water Program, established by Section 208(j) of the Clean Water Act of 1977, which would control agriculturally nonpoint sources of pollution on private lands.

Flooding problems cited above are addressed in the plan by many recommended Army Corps of Engineers programs. Flooding occurs in many small communities where presently no feasible and acceptable structural solutions are available. To address these problems, a number of studies are recommended for the post 1986 period, by which time social or economic conditions may have changed enough to warrant new investigation. These studies involve the Boyer River, Floyd River Basin, Little Sioux River Basin, Nishnabotna River Basin, Soldier River Basin, and Papillion Creek and tributaries.

Many small watershed projects are recommended for rural areas, although many rural flooding problems remain unaddressed. Because watershed planning and construction costs are quite high

and the funding level for this program is relatively low, the need for this program will exist for a good many years.

The important problem of loss of wetlands and effects on fish and wildlife caused by construction, operation, and maintenance of the navigation on the Missouri River main stem is addressed by the Corps of Engineers' Missouri River Fish and Wildlife Mitigation Study. Another important recommendation concerns the problem of municipal, industrial, and rural water supply. In recreation orientated growth areas, utility systems have not kept up with the demand. Coordinated region-wide, water-delivery systems are needed. The plan recommends restrictions be removed in the Farmers' Home Administration's rural water supply program that limit the design of rural water and wastewater disposal systems for future expansion.

RECOMMENDED PROGRAMS - MIDDLE MISSOURI

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-NORTHERN MISSOURI RIVER TRIBS COOP STUDY, MO., IA USDA/Soil Conservation Service Comprehensive Also in Lower Missouri Subbasin	Ongoing river basin planning thru FY 82; eleven reports completed; develop alternate plans on major streams; study cost $2.2 million.
2-MISSOURI RIVER TRIB, SIOUX CITY, KANSAS CITY, SUBREG. AN. Missouri River Basin Commission Comprehensive	New start river basin planning beginning in FY 84; tributaries of Missouri River between Sioux City and Kansas City; IA, KS, MO, NE; cost $300,000.
3-SOUTHWEST IOWA WATER RESOURCES STUDY Iowa Geological Survey Comprehensive Also in Lower Missouri Subbasin	New start data collection & research beginning in FY 82; five year comprehensive water supply availability study; cost $750,000.
4-NORTHWEST IOWA WATER RESOURCES STUDY Iowa Geological Survey Comprehensive	Ongoing data collection thru FY 82; five year test drilling program for stratigraphic model water availability; cost $750,000.
5-SOUTHERN IOWA RESOURCE CONSERVATION & DEVELOPMENT AREA,IA USDA/Soil Conservation Service Comprehensive Also in Lower Missouri Subbasin	Ongoing program implementation thru FY 82; Adair Adams, Taylor, Ringold, Decatur, Wagner, & Clark counties; cost $2,080,000.
6-GOLDEN HILLS RESOURCE CONSERVATION & DEVELOPMENT AREA, IA USDA/Soil Conservation Service Comprehensive	New start, program implementation; Harrison Shelby, Pottawattamie, Cass, Mills, Montgomery, Fremont & Page counties; application only, no funding.

7-NEBRASKA RIVER BASINS SPECIAL STUDIES
USDA/Soil Conservation Service
Comprehensive
Also in E. and W. Dakotas & Platte-Niobrara Subbasins

Ongoing special studies of erosion, sediment, rural water and flooding in Missouri tribs and White-Hat basins; prime farmland mapping in Platte critical habitat areas; cost $1.3 million; FY 79-84.

8-STATEWIDE RIVER BASIN STUDY, MISSOURI
USDA/Soil Conservation Service
Comprehensive
Also in Lower Missouri Subbasin

New start special study beginning in FY 82; statewide comprehensive study in water and land resources; involves SCS, ESCS & FS; study cost $925,000.

FLOODING

9-FLOOD PLAIN MANAGEMENT PROGRAM FOR THE MISSOURI RIVER
Missouri River Basin Commission
Flooding, Land Conservation & Management
Also in Lower Missouri and Eastern Dakotas Subbasins

New start special study beginning in FY 82; Missouri River mainstem from near Sioux City, IA, to the mouth near St. Louis, Missouri; study cost $400,000.

10-MISSOURI RIVER LEVEE SYSTEM
Army Corps of Engineers
Flooding, Land Conservation & Management
Also in Lower Missouri Subbasin

Ongoing program implementation detailed study; flood protection mainstem Sioux City, Iowa, to mouth; active L-611, L-614, R-616; thru 81; $6.7 million bal. to complete $85.3 million.

11-BOYER RIVER BASIN LEVEL C STUDY, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no feasible solutions under existing program for flood & bank erosion control and related purposes; cost $294,000.

12-FLOYD RIVER BASIN REVIEW REPORT, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no feasible solutions under existing program for flood control and related purposes; cost $365,000.

13-LITTLE SIOUX RIVER BASIN REVIEW REPORT, IOWA
Army Corps of Engineers
Flooding, Land Conservation & Management

Deferred feasibility study; post FY 86; no feasible solutions under existing program for flood control and related purposes; cost $327,000.

14-NISHNABOTNA RIVER BASIN REVIEW REPORT, IOWA Army Corps of Engineers Flooding, Land Conservation & Management	Deferred feasibility study; post FY 86; no feasible solutions under existing programs for flood control and related purposes; cost $432,000.
15-SOLDIER RIVER BASIN REVIEW REPORT, IOWA Army Corps of Engineers Flooding, Land Conservation & Management	Deferred feasibility study; post FY 86; no feasible solutions under existing programs for flood control and related purposes; cost $310,000.
16-PAPILLION CREEK AND TRIBUTARIES PROJECT, NEBRASKA Army Corps of Engineers Flooding, Land Conservation & Management	Inactive program implementation; reservoirs for flood control, recreation and fish & wildlife facilities, inactive pending resolution of conflicts and litigation; cost to date $74.5 million.
17-METROPOLITAN SIOUX CITY AND MISSOURI RIVER, IA, NE, & SD NEBRASKA AND SOUTH DAKOTA Army Corps of Engineers Flooding, Land Conservation & Management	Ongoing feasibility study-program implementation for flood control and related purposes on Perry Creek, Sioux City, IA, cost $20.5 million.
18-PLATTE RIVER RESTUDY, MISSOURI Army Corps of Engineers Flooding, Land Conservation & Management	New start feasibility study beginning FY 81; restudy of authorized Platte River channel improvements to determine feasibility; cost $160,000.
19-MAIN DITCH NO. 6 NEAR HAMBURG, IOWA Army Corps of Engineers Flooding, Land Conservation & Management	New start special study; local flood protection reconnaissance study. Completion scheduled FY 81; study cost $150,000.
20-EAST NISHNABOTNA RIVER AT RED OAK, IOWA Army Corps of Engineers Flooding, Land Conservation and Management	Resumption feasibility study; local flood protection-detailed progress report. Construction started, expected completion FY 81; project cost estimate $900,000.

21-KANSAS AND OSAGE RIVERS STUDY, KANSAS Army Corps of Engineers Flooding, Land Conservation & Management	Ongoing special study thru FY 83; streambank stab. on KS River & tribs, mineral pollution control in KS River Basin & additional water supply & distrib. in KS & Osage; study cost $4.5 million.
22-A&T LONG BRANCH WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adams & Taylor counties; recommended for planning; project envisions 25 grade stabilization structures; cost $2 million.
23-ALLEN-STEER CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Harrison & W. Pottawattamie counties; recommend for planning; project envisions 21 grade stabilization structures; cost $9.8 million.
24-CBS WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Page County; recommended for planning; project envisions 40 grade stabilization structures; cost $5.5 million.
25-COBB CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Harrison County; recommended for planning; project envisions 8 grade stabilization structures; cost $500,000.
26-EAST 102 RIVER WATERSHED PROJECT, IOWA, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Taylor County; recommended for planning; project envisions 5 flood detention structures; cost $2.7 million.
27-ELK CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Harrison & Monona counties; recommended for planning; project envisions 40 grade stabilization structures; cost $2.4 million.
28-JAMES CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Plymouth & Woodbury counties; recommended for planning; project envisions 12 grade stabilization structures; cost $600,000.

29-LONG BRANCH WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Audubon & Shelby counties; recommended for planning beginning in FY 83; project envisions 4 grade stabilization structures; cost $1 million.
30-MAIME CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in W. Pottawattamie County; recommended for planning; project envisions 10 grade stabilization structures; cost $600,000.
31-MIDDLE 102 RIVER WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Taylor County; recommended for planning; project envisions 2 flood detention structures; cost $2 million.
32-MILL CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Page County; recommended for planning project envisions 30 grade stabilization structures; cost $1.8 million.
33-PACS INDIAN CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Aududon, Cass, Pottawattamie & Shelby counties; recommended for planning; project envisions 5 flood detention structures; cost $6 million.
34-PLATTE RIVER WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adams, Ringold, Taylor & Union counties recommended for planning; project envisions 7 flood detention structures; cost $5.2 million.
35-ROCKY BRANCH OF PAGE WATERSHED, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Page County, recommended for planning project envisions 22 grade stabilization structures; cost $2.5 million.

36-ROSS WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Page County, recommended for planning; project envisions 11 grade stabilization structures cost $600,000.
37-SOLDIER, BEAVER WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Crawford and Ida counties; recommended for planning; project envisions 70 grade stabilization structures; cost $4.5 million.
38-SHOW CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adams County; recommended for planning project envisions 1 flood retention structure and 3 grade stabilization structures; cost $350,000.
39-UPPER MOSQUITO WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Crawford & Shelby counties; recommended for planning; project envisions 50 grade stabilization structures; cost $3.5 million.
40-WEST 102 RIVER WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adams & Taylor counties; recommended for planning; project envisions 3 flood detention structures; cost $5.7 million.
41-WEST NODAWAY WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adams, Cass, Adair & Montgomery counties; project envisions 6 flood control structures; cost $3.7 million.
42-WEST TARKIO WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Fremont, Page & Montgomery counties; project envisions 8 grade stabilization structures; cost $10 million.
43-PONY CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Brown & Nemaha counties; recommended for planning beginning FY 80; project envisions 52 flood detention structures; cost $3.2 million.

44-CLEAR, CAYHOGA, MUDDY CREEKS, WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Nodaway County; recommended for planning post FY 84; project envisions 4 flood detention structures & 30 grade stabilization structures; cost $2.1 million.
45-LOWER 102 RIVER, WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Nodaway County; recommended for planning post FY 84; project envisions 30 grade stabilization structures; cost $1.4 million.
46-WESTON'S BEAR CREEK WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Platte County; recommended for planning post FY 84; project envisions 10 grade stabilization structures; cost $700,000.
47-LOWER BIG NEMAHA WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Pawnee County; recommended for beginning in FY 84; project envisions 4 flood detention structures & 20 grade stabilization structures; cost $3 million.
48-BIG MUDDY WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Flooding, Land Conservation & Management	Watershed in Richardson County; recommended for planning beginning in FY 81; project envisions 12 flood detention structures & 1 multipurpose structure; cost $3.9 million.
49-SQUAW-CAMP WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Otoe County; recommended for planning beginning FY 82; project envisions 14 grade stabilization structures; cost $1.6 million.
50-PERU-BROWNVILLE WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Nemaha County; recommended for planning beginning FY 84; project envisions 12 grade stabilization structures; cost $1.5 million.

51-LOWER LITTLE NEMAHA WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Otoe & Nemaha counties; recommended for planning beginning in FY 80; project envisions 9 flood detention structures & 40 grade stabilization structures; cost $3 million.
52-TURKEY CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Pawnee County; recommended for planning beginning in FY 81; project envisions 19 flood detention structures, 1 multipurpose structure & 15 grade stabilization structures; cost $4 million.
53-WEEPING WATER WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Cass County; recommended for planning beginning in FY 83; project envisions 22 grade stabilization structures; cost $2 million.
54-HACKLEBARNEY WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adams & Montgomery Counties; planning underway FY 80; project envisions 150 grade stabilization structures; cost $6.3 million.
55-TWIN PONIES WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Mills & W. Pottawattamie counties; planning underway FY 82; project envisions 16 flood detention structures; cost $4.8 million.
56-ROY'S CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Brown County; active planning underway; project envisions 48 flood retention structures; cost $2.8 million.
57-WOLF RIVER WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Brown & Doniphan counties; active planning underway; project envisions 180 grade stabilization structures; cost $18 million.

58-MOZINGO WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Nodaway County; planning underway FY 79 project envisions 1 multipurpose structure & 4 grade stabilization structures; cost $12.4 million.
59-SOUTH BRANCH LITTLE NEMAHA WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Johnson, Lancaster & Otoe counties; planning underway FY 80; cost $6.8 million.
60-MIDDLE BIG NEMAHA WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Johnson County; planning underway FY 81 project envisions 19 flood detention structures 1 multipurpose structure & 25 grade stabilization structures; cost $4 million.
61-UPPER LITTLE NEMAHA WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Lancaster & Otoe counties; planning underway FY 82; project envisions 18 flood detention structures, 1 multipurpose structure & 35 grade stabilization structures;cost $3.5 million.
62-BACON CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Plymouth & Woodbury counties; construction completing FY 85; project involves 5 flood detention structures, 1 multipurpose struc. & 31 grade stabilization struc.; cost $4.5 million.
63-BEE-JAY WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in E. Pottawattamie County; construction underway FY 79; project involves 17 grade stabilization structures; cost $668,000.
64-BLOCKTON WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Taylor County; construction underway; project involves 3 flood detention structures & 27 grade stabilization structures; cost $2.3 million.

65-DANE RIDGE WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Crawford County; construction underway FY 79; project involves 40 grade stabilization structures; cost $3.4 million.
66-DAVID'S CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Audubon & Guthrie counties; construction underway FY 79; project involves 58 grade stabilization structures; cost $3.9 million.
67-HELD WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Plymouth County; construction underway FY 79; project involves 23 grade stabilization structures; cost $1.7 million.
68-INDIAN CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in W. Pottawattamie County; construction underway FY 79; project involves 15 grade stabilization structures; cost $2.3 million.
69-LEDGEWOOD CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Fremont County; construction underway; project involves 14 grade stabilization structures; cost $1.3 million.
70-MILL-PICAYUNE CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Crawford, Harrison & Shelby counties; construction underway; project involves 6 flood detention structures, 155 grade stabilization structures; cost $15.2 million.
71-MOSQUITO OF HARRISON WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Harrison & Shelby counties; construction underway; project involves 57 grade stabilization structures; cost $4.7 million.

72-NORTH PIGEON WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in W. Pottawattamie County; construction underway; project involves 18 grade stabilization structures; cost $2.1 million.
73-PIERCE CREEK #2 WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Page & Montgomery Counties; construction underway; project involves 9 grade stabilization structures; cost $466,000.
74-PONY CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Mills & W. Pottawattamie counties; construction underway; project involves 2 flood detention structures, 21 grade stabilization struc. & 4.3 mi. channel; cost $4.4 million.
75-RYAN-HENSCHAL WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in W. Pottawattamie County; construction underway FY 79; project involves 17 grade stabilization structures; cost $1.9 million.
76-SIMON RUN WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in W. Pottawattamie County; construction completion FY 85; project involves 11 grade stabilization structures; cost $1.1 million.
77-TURKEY CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adair, Audubon, Cass & Guthrie counties; construction completion FY 87; project includes 10 flood detention structures & 103 grade stabilization structures; cost $11.7 million.
78-TWELVE MILE CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adair & Union counties; construction completion FY 87; project involves 22 flood detention structures, 1 multipurpose structure & 11 grade stabilization structures; cost $6.8 million.

79-WALTERS CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adams County; construction underway; project involves 2 flood detention structures, 1 multipurpose structure & 37 grade stabilization structures; cost $5.5 million.
80-WAUBONSIE CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Mills & Fremont counties; construction completion FY 85; project involves 32 grade stabilization structures; cost $4.3 million.
81-TROUBLESOME CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Audubon, Cass & Guthrie counties; construction completion FY 90; project involves 2 flood detention structures, 2 multipurpose structures & 135 grade stab. structures; cost $8.8 million.
82-LAKES OKABENA AND OCHEDA WATERSHED PROJECT, MINNESOTA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Nobles County; constr. underway; project envisions land treatment, 1 desilting basin, 1 wildlife struc., 1 multipurpose struc., 5.4 mi. channel improve. & 1 mile water divert; $1.5 million.
83-LONG BRANCH WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Johnson, Nemaha, Pawnee & Richardson counties; construction to begin FY 87; cost $3.1 million.
84-PAPILLION CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Douglas & Washington counties, construction to begin FY 86; project envisions 52 grade stabilization structures; cost $3.9 million.
85-ROCK CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Pawnee County; construction to begin FY 82; project involves 5 flood detention structures & 12 grade stabilization structures; cost $1 million.

86-SOUTH FORK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Pawnee & Richardson counties; construction to begin FY 86; project envisions 2 flood detention structures, 1 multipurpose structure & 14 grade stabilization structures; cost $1.7 million.
87-SPRING CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Johnson, Otoe & Nemaha counties; construction to begin FY 82; project involves 7 flood detention structures & 21 grade stabilization structures; cost $1.8 million.
88-TEKAMAH/MUD WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Burt County; construction to begin FY 84; project envisions 4 flood detention structures, 1 multipurpose structure & 10 grade stabilization structures; cost $2.8 million.
89-UPPER BIG NEMAHA WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Gage, Johnson, Lancaster & Otoe counties; construction to begin FY 87, project includes 38 flood detention structures & 59 grade stabilization structures; cost $7.3 million.
90-WILSON CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Cass & Otoe counties; construction to begin FY 85; project envisions 22 flood detention structures & 67 grade stabilization structures; cost $5.8 million.
91-WINNEBAGO-BEAN WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Richardson County; construction to begin FY 82; project includes 16 grade stabilization structures; cost $1.4 million.

FISH AND WILDLIFE

92-MISSOURI RIVER FISH & WILDLIFE MITIGATION STUDY Army Corps of Engineers Fish and Wildlife Also in Lower Missouri Subbasin	Ongoing special study thru 81; all counties bordering main stem Missouri; NE, IA, KS, MO; compensation for F&W loss & habitat improvement; cost $273,000.

IRRIGATION

93-OTOE-CASS UNIT APPRAISAL STUDY, NEBRASKA
DOI/Water and Power Resources Service
Irrig., F&W, M&I Rural Supply, Rec., Water Qual.

Ongoing feasibility study thru FY 80; potential for pumping water from Mo River; cost $200,000.

LAND CONSERVATION AND MANAGEMENT

94-WESTERN IOWA RIVERS COOPERATIVE STUDY
USDA/Soil Conservation Service
Land Cons. & Mgt., Flood, Irrig., Water Qual.
Also in Eastern Dakotas Subbasin

New start regional planning beginning in FY 82; Iowa tribs to Mo River from Big Sioux to/but excluding Nishnabotna involves SCS, ESCS & FS; cost $1.5 million.

95-NORTHEAST KANSAS WATER QUALITY STUDIES
USDA/Soil Conservation Service
Land Conservation & Management, Water Quality
Also in Kansas Subbasin

New start special study beginning in FY 80; study of Delaware, Nemaha, Blue Rivers & Stranger Creek sources & amount of sediment; monitor land treatment; cost $205,000.

MUNICIPAL, INDUSTRIAL AND RURAL DOMESTIC WATER SUPPLY

96-SMITHVILLE LAKE, MISSOURI
Army Corps of Engineers
M&I Rural Supply, Flood, F&W, Rec., Water Qual.

Ongoing program implementation of a multipurpose lake for water supply, flood control, fish and wildlife, recreation, and improved water quality; total cost $83.7 million.

NATURAL, HISTORIC AND CULTURAL RESOURCES

POWER AND ENERGY

WATER-ASSOCIATED OUTDOOR RECREATION

97-LAKE MANAWA, IOWA
Iowa Conservation Comm.
Recreation

Ongoing program implementation thru FY 83; development of diking & levees near Council Bluffs, Pottawattamie County; cost $1.2 million.

TRANSPORTATION

98-MISSOURI RIVER NAVIGATION AND BANK STABILIZATION CONTROL PGM
Army Corps of Engineers
Transportation, Recreation
Also in Lower Missouri Subbasin

Ongoing program implementation thru FY 83; improved navigation channels, bank erosion & stab. measures & recreation - 95% complete, 2 Oxbow Lakes & 26 river sites, NE, IA, & MO; cost $430 million.

WATER QUALITY

LEGAL AND INSTITUTIONAL FACTORS

INSTREAM FLOWS

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. Nonpoint source pollution is a major Middle Missouri Subbasin problem. Steep slopes and loess soils in Iowa, northwest Missouri, southwest Nebraska, and northeast Kansas cause severe gully erosion. Streambank erosion is a particular problem in the Nemaha Basin, Nebraska, and Nishnabotna and Nodaway Basins in Missouri. Nebraska counties between South Sioux City and Omaha have the highest soil loss rates in the State. To address agricultural runoff problems, it is recommended that the Rural Clean Water Program (Section 208(j) of the Clean Water Act of 1977), which would control agricultural related nonpoint sources of pollution on private rural lands, be funded and implemented.

B. Flooding is still a problem along many of the tributary streams in the Middle Missouri Subbasin. In many of the smaller communities, present planning and evaluation criteria and social preferences preclude formulation of a feasible, acceptable structural solution.

C. Even though levees have been constructed along the Missouri River, flooding continues to be a problem downstream of the Platte River in Nebraska. Private levees are being moved or constructed too close to the river infringing on the floodway and shifting flood damage to other areas.

D. Tie back levees on tributary streams were designed to provide 50 year protection from flooding caused by main stem flooding and tributary flooding. Due to numerous factors, including aggradation of the stream beds of the tributaries, this level of protection has dropped to 10 to 25 year events.

E. Consumptive use and diversion of upstream States will decrease the amount of water available for downstream uses. It is recommended that an investigation of interstate water allocation be initiated by the Missouri River Basin Commission. The investigation should be directed toward assessing alternative institutional arranagements for developing an interstate compact for the Missouri River.

F. Projected power demands will necessitate the construction of additional power plants in the subbasin. The maximum energy

potential from water use by low head hydropower should be developed. Power plants should be located on major rivers to permit the assimilation of cooling water with the least possible adverse environmental effects. Disposal of power plant waste water into smaller bodies of water where thermal pollution can be reduced could provide an opportunity for improved production of fish.

G. Drinking water quality problems occur in Otoe and Cass Counties, Nebraska, the Sioux City, Iowa, area and southwest Iowa. Better planning to recognize regional water requirements is needed for rural domestic systems. Coordinated planning to design regional delivery systems is necessary. States should work toward amending legislation and regulations so that new rural development is capable of utilizing the Farmers Home Administration resource which could be used to improve rural water and waste water disposal systems through consolidation of districts.

H. Oxbow lake elimination and channel straightening is reducing and changing fisheries habitat. The loss of wetlands is not being replaced by maturing wetlands, which are rapidly being converted to agricultural uses. Fish and wildlife are being adversely affected in the subbasin by many of man's activities. Programs similar to Missouri's "Design for Conservation" should be initiated by other States.

I. There is a documented demand for access and recreation facilities that are water-oriented in metropolitan areas such as Sioux City and Council Bluffs, Iowa, St. Joseph, Missouri, and in southwest Iowa. Additional attention needs to be directed toward meeting this need.

J. The Middle Missouri Subbasin lacks adequate data on land use and associated water use. Such data are necessary for planning and management. A study to obtain such information is recommended. It is specifically recommended that Iowa increase funding for State land use and water-related program planning.

CHAPTER 9

KANSAS SUBBASIN

SUBBASIN DESCRIPTION

The Kansas Subbasin, lying along the southern edge of the Missouri River Basin, encompasses about 38.9 million acres. As shown in figure 12, the subbasin includes all of the land drained from west to east by the Kansas River and its tributaries in Colorado, Kansas, and Nebraska. It has a maximum east-west width of nearly 500 miles and a maximum north-south extent of about 220 miles. Generally, the topography is gently rolling, punctuated by scattered buttes, knobs, and level country. Elevations range from 6,000 feet (mean sea level) in the Colorado high plains downward to about 750 feet at the confluence of the Kansas and Missouri Rivers at Kansas City.

The subbasin is dominated by agricultural land use. Woodlands and forests border the major streams and rivers of the subbasin and provide important habitat for wildlife and birds. The subbasin's numerous manmade reservoirs and farm ponds provide good quality warm water fisheries. Natural wetlands scattered throughout the subbasin provide critical production areas for waterfowl.

In 1975, the total human population of the Kansas Subbasin was estimated to be 1.3 million. Urban residents constituted 62 percent of the total and generally are concentrated toward the eastern third of the subbasin. This component of the population is projected to increase by more than 50 percent by the year 2000. In contrast, rural population is expected to decline due to decreasing farm size and out-migration of rural youth. Nearly

Figure 12-Kansas Subbasin

half of the subbasin's population resides in the area's two Standard Metropolitan Statistical Areas, Kansas City and Topeka. An estimated 2,200 native American Indians live in the Kansas subbasin.

Most of the economic activity in the subbasin is related to agriculture, although refining and processing of fuels is gaining importance in the western areas. Major dryland crops are winter wheat, grain sorghum, and corn; irrigated acreage is mostly in corn, alfalfa, and sugar beets. Beef cattle and hogs are the principal livestock products.

Water availability is highly variable across the Kansas Subbasin. Most streams are subject to severe seasonal fluctuations in flows. Exceptions are stream reaches regulated by reservoir releases and those in the extreme eastern portion of the subbasin, where precipitation is greatest.

Ground water is abundant in most stream alluvia and also in the vast Ogallala aquifer underlying the western third of the area. However, ground water pumping for irrigation is causing severe localized declines of ground water levels.

The major water use is for crop irrigation, comprising over 90 percent of withdrawals and consumptive use. Federal reservoirs play an important role in providing water supplies for irrigation systems and municipalities.

Water quality of the subbasin's streams and rivers is fair. Seasonal degradation occurs due to runoff from agricultural lands and when low flows cause increases in naturally occurring mineral concentrations. Ground water is generally hard, but the quality is adequate for most uses.

Two of the subbasin's major streams, the Republican River and the Big Blue River, are subject to interstate compacts. The Republican River Interstate Compact allocates waters among Colorado, Kansas, and Nebraska based upon the computed annual supply under natural conditions. Under the Big Blue River compact, Nebraska guarantees specified minimum flows in the Big Blue and Little Blue Rivers entering Kansas.

The three Kansas Subbasin States for the most part adhere to the system of prior appropriation in determining water allocation for beneficial uses. Beneficial uses are specifically defined in all three States, and generally include domestic, municipal, and

agricultural. Colorado further recognizes water use for instream flows for fisheries habitat and recreation, and will issue water rights for such reservations.

Management of ground water in Kansas and Nebraska is limited to the creation of optional ground water management districts in areas of critical concern. Colorado apportions ground water in a manner similar to surface waters, requiring the granting of a water right by the State regulatory agency.

PROBLEMS AND OPPORTUNITIES

The major problems in the Kansas Subbasin involve irrigation water supply, flooding, municipal and rural water supply, erosion, fish and wildlife habitat, and water quality. Important opportunities exist in the subbasin for increased irrigation.

There are two types of problems involving irrigated agriculture, lack of adequate surface water supply and diminishing ground water supplies. Considerable amounts of cropland are irrigated using surface water systems, including a number of large Water and Power Resources Service projects. Irrigators dependent upon water from surface projects in the Republican River drainage in Nebraska face declining water availability caused by upstream ground water pumping. Rapidly increasing development of sprinkler irrigation systems utilizing ground water is diminishing the flows available to Federal surface impoundments and thus to the irrigation districts involved.

In several areas, irrigators using ground water face diminishing supplies, declining water levels, and increasing costs for pumping. The problem of declining water tables is particularly acute in the Ogallala aquifer underlying the western portion of the subbasin including the Upper Republican River Basin. Other areas subject to severe ground water decline are located in the Big and Little Blue basins in Nebraska.

Opportunity for irrigating high quality cropland exists at several areas. In Kansas, irrigable lands below Glen Elder and Kanapolis Reservoirs could be developed for surface water delivery systems. Opportunity also exists for expanding irrigation in eastern Colorado using water impounded in Bonny Reservoir. In Nebraska, suitable lands in the Big Blue and Little Blue basins have potential for development of irrigation systems. Institutional conflicts involving diversion of water

from the Platte River for use in the Little Blue Basin have restricted such actions.

Flooding is a chronic problem on rural lands adjoining the subbasin's streams and at a number of urban and builtup areas. Cities and small towns in the Big Blue and Little Blue basins above Tuttle Creek Reservoir are subject to recurring floods during periods of unseasonably high runoff. Debris clogged channel conditions often compound the problem.

Rural flooding occurs on streamside lands throughout the basin, particularly on the major tributaries. On the Republican River below Harlan County Dam, diminished channel capacity contributes to overbank flooding problems.

A number of cities in Kansas depend on surface water for their municipal supply. During periods of low flows on the Kansas River, the quality of municipal supplies for Topeka, Manhattan, and Lawrence is degraded because of naturally occurring saline concentrations. Also, in some instances, existing storage allocations in Federal reservoirs in Kansas restrain the State from marketing water to municipalities.

Most smaller towns and rural inhabitants use ground water for domestic supply. The quality of most supplies is marginally adequate, and many rural areas are in need of upgraded systems.

Erosion of several types affects the subbasin's lands. Streambank erosion is most severe along the Kansas River, but also affects reaches of the Big Blue, Little Blue, Republican, Smoky Hill, Solomon and Saline rivers. High banks at Harlan County Reservoir on the Republican River are severely eroded by wave action.

Soil erosion and resulting sedimentation are a problem in the northeastern portion of the basin where precipitation is greatest and slopes are more prone to such effects. Wind erosion affects agricultural lands on the high plains of western Kansas, eastern Colorado, and southwestern Nebraska.

Preservation of suitable fish and wildlife habitat is a concern throughout the subbasin. Land available for wildlife is being diminished by agricultural practices, including drainage of wetlands and reduction of fencerows, roadside habitat, and other odd acreages. Wetland preservation is particularly important in Nebraska's Rainwater Basin, an important waterfowl propagation area.

PLANNING OBJECTIVES

The three subbasin States differ somewhat in their views of comprehensive water resources planning and in their preparation of State water plans. Colorado has completed two of three phases of a traditional State water plan, a resource inventory and legal framework, both done in cooperation with the Water and Power Resources Service. The State's near term objective is to prepare phase III, the water resources management plan.

In Kansas, the State water plan is coordinated through the Water Resources Board, and portions are prepared with assistance from Federal agencies. The plan is effected only after legislative enactment and is updated on a regular basis.

Nebraska has abandoned the concept of a State framework plan in favor of a recently enacted State water planning and review process. The process is intended to be issue oriented, with the near term objective of providing the basis for wise legislative decisions concerning the State's water resources.

It is an objective of all three States to promote the development of irrigated agriculture. Each recognizes irrigation as a high priority beneficial use of water necessary for the State's economy. A specific objective of the State of Kansas is to reduce the rapid decline of ground water resources necessary for irrigation in the western part of the State. Colorado wants to provide additional storage for irrigation water on the South Platte River and its tributaries, and promotes system rehabilitation and other water conservation measures. Further, Colorado opposes the conversion of prime agricultural land and water suitable for irrigated agriculture to other uses. In Nebraska, the State legislature has declared the use of water for irrigation "natural want", which illustrates the high priority attached to irrigation in Nebraska.

Each of the three States in the Kansas Subbasin desires to reduce damages caused by floods through a combination of structural and nonstructural measures. Kansas has enacted legislation which defines the specific levels of flood protection to be provided for various types of lands.

Although it is an objective of each State to preserve fish and wildlife resources and habitat, only Colorado officially

recognizes the maintenance of instream flows for habitat as a beneficial use.

The three States desire to provide increased quantity and improved quality of municipal, industrial, and rural domestic water. Colorado objectives call for cooperation between Federal, State, and local entities to provide for the water supply needs. The State specifically promotes employment of water conservation measures to reduce per capita use in municipal systems. Kansas statutes specify the State goal of providing municipal and industrial water in the near term future. Kansas promotes the State marketing of water stored in Federal reservoirs to local entities for municipal and industrial supply.

State objectives concerning the preservation of natural, historic, and cultural resources differ slightly among the Kansas Subbasin States. Colorado calls for an identification of significant natural areas, studies of riparian habitat, and an updated wetlands inventory, leading to restoration of certain wetlands. State policy in Kansas presently does not address preservation of wetlands or river corridors, but historic and cultural features are protected under State laws. Nebraska objectives call for investigation of potential protected streams in upcoming policy issue analyses.

Each of the States wants to provide improved water-based outdoor recreation for its citizens. A goal in Colorado is to expand recreational use of private and public water bodies. The State calls for operational studies to improve recreation opportunities and for local entities to work toward providing recreational access to private reservoirs. In Kansas, recreation is considered a by-product of water resources planning; no reservoir storage is specifically allocated for this purpose. Nebraska encourages local political subdivisions to provide recreational opportunities.

Finally, both Kansas and Colorado promote weather modification for its potential economic benefits. Both States regulate operations involving precipitation augmentation and hail suppression.

PLAN OVERVIEW

The plan for the Kansas Subbasin includes the programs and conclusions and additional recommendations in this chapter, the basinwide recommended programs listed in chapter 2, and the

statewide programs recommended for Colorado, Kansas, and Nebraska, also contained in chapter 2.

In order to advance water resources planning in Colorado, the recommended plan calls for the Water and Power Resources Service to provide assistance to the State of Colorado in completing its State water plan (beginning in FY 1982). Water planning in the State of Kansas will benefit from the Water and Power's water management studies in the Solomon and Republican River Basins. The recommendation for continuing the Water and Power Resources Service study in the Republican River Basin should contribute to Nebraska's planning and review process.

A number of projects and programs are recommended to deal with flooding problems in the Kansas Subbasin. The plan contains 33 Soil Conservation Service small watershed projects, 23 in Kansas and 10 in Nebraska. Also, it is recommended that the Corps of Engineers complete its study of flooding in the Stranger Creek Basin and construct local flood control works at Onaga Dam and Reservoir on Vermillion Creek in eastern Kansas.

Development of irrigated agriculture is a high priority in the Kansas Subbasin States. The plan recommends a combination of system rehabilitation, new project development, and feasibility studies to enhance irrigation. The Water and Power Resources Service is called upon to complete the Bostwick Division in Kansas and the Frenchman-Cambridge Division in Nebraska. Further, the plan recommends that the Service study the feasibility of a number of irrigation projects including the Little Blue Unit, Nebraska; Glen Elder Unit, Kansas; and Scandia Unit, Kansas. A feasibility study is recommended to investigate diversion of Platte River flows into the Little Blue River Basin in Nebraska to be stored and utilized for irrigation of cropland.

In an attempt to deal with the problem of rapidly declining ground-water levels in Kansas' Ogallala aquifer, the plan recommends that a pilot recharge project be initiated by the Kansas Water Resources Board and local ground water management districts. The plan also calls for State and local investigations of irrigation feasibility utilizing surplus water in Bonny Reservoir, an existing Federal impoundment on the South Fork Republican River in Colorado.

To address the problems of erosion and sedimentation in northeastern Kansas the plan recommends that the Soil Conservation Service conduct the proposed "Northeast Kansas Water

Quality Studies." The Department of Agriculture's "Rural Clean Water Program," recommended basinwide, will further aid in control of agricultural nonpoint source pollution.

Supply of adequate municipal, industrial, and rural domestic water is addressed by plan elements recommended both basinwide and specifically for the Kansas Subbasin. The Farmers Home Administration is recommended to participate with State and local entities in carrying out the program "Rural Water Supply and Waste Disposal Systems." Also recommended is construction of the water supply component of the existing Kanapolis Unit, a multipurpose impoundment on the Smoky Hill River. The city of Salina will benefit from the project.

RECOMMENDED PROGRAMS - KANSAS

NAME, LEAD AGENCY, AND FUNCTIONS ADDRESSED	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-SOLOMON RIVER BASIN WATER MANAGEMENT STUDY DOI/Water and Power Resources Service Comprehensive	Ongoing regional water management study to investigate water supply and use and ground/surface conjunctive use in Kansas' Solomon R. basin; completion scheduled FY 83; cost $1.6 million.
2-REPUBLICAN RIVER BASIN WATER MANAGEMENT STUDY; KS, NE, CO DOI/Water and Power Resources Service Comprehensive	Ongoing regional water management study to investigate water supply and use and ground/surface conjunctive use in the 3-State Republican R. basin; completion scheduled FY 83; cost $1.4 million.
3-COLORADO STATE WATER PLAN, PHASE III DOI/Water and Power Resources Service Comprehensive Also in Platte-Niobrara Subbasin	Proposed new start studies to prepare the Phase III development plan; Colorado State agencies will participate; $570,000 programmed for FY 83; $290,000 for FY 84.
4-EAST CENTRAL COLORADO RC&D AREA, COLORADO USDA/Soil Conservation Service Comprehensive Also in Platte-Niobrara Subbasin	Ongoing feasibility study in Elbert, Lincoln, Kit Carson, & Cheyenne Counties; annual funding requirements are $70,000 through FY 82.
5-OVERLAND TRAILS RC&D AREA, COLORADO USDA/Soil Conservation Service Comprehensive Also in Platte-Niobrara Subbasin	Proposed FY 81 feasibility study start in Logan, Morgan, Sedgwick, Phillips, Washington & Yuma Counties; annual funding requirements are $70,000 through FY 82.

6-FOUR RIVERS RC&D AREA, KANSAS USDA Soil Conservation Service Comprehensive	Ongoing feasibility study in eastern Kansas; annual funding requirements are $50,000 FY 80; $40,000 FY 81; $30,000 FY 82.
7-KANSAS AND OSAGE RIVERS STUDY, KANSAS Army Corps of Engineers Comprehensive Also in Lower Missouri Subbasin	Ongoing special study thru FY 83; streambank stabilization on KS. R. & tribs; mineral pollution control in KS. R. basin; water supply and distribution in KS. and Osage; study cost $4,540,000.

FLOODING

8-STRANGER CREEK BASIN STUDY, KANSAS Army Corps of Engineers Flooding, Recreation, Municipal, Industrial & Rural Supply	Ongoing feasibility study of flood control alternatives for Stranger Creek basin in eastern Kansas; structural & nonstruc. considered; study completion FY 82; study cost $590,000.
9-ONAGA LAKE, KANSAS Army Corps of Engineers Flooding, Fish & Wildlife, Recreation, Water Supply	Preconstruction planning of dam and reservoir on Vermillion Creek in E. Kan. to provide flood control, water supply, rec.; project completion not yet determined; cost estimate $69.5 million.
10-CHANNEL GEOMETRY/DISCHARGE CHARACTERISTICS STUDY, KANSAS DOI/Geological Survey Flooding	Ongoing special study to identify channel characteristics of streams having dams; study completion scheduled for FY 80; study cost $150,000; cost-shared with KS. Water Resources Board.

11-CEDAR CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 86; located in Atchison, Jefferson, and Jackson Cos.; includes 45 grade stab. structures; cost estimated at $3.5 million.
12-SNIPE CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 90; located in Marshall County; includes 10 grade stabilization structures; cost estimated at $800,000.
13-SPRING CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 84; located in Marshall county; includes 40 grade stabilization structures; cost estimated to be $1.9 million.
14-SPRING-STRAIGHT WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 84; located in Atchison Jackson, and Nemaha Cos.; includes 60 grade stab. structures; cost estimated at $4.6 million.
15-VERMILLION (ROBIDOUX) WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 92; located in Marshall County; includes 39 grade stab. structures; cost estimated at $2.6 million.
16-LOWER MILL CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 82; located in Wabaunsee, Jackson, and Nemaha Cos,; includes 4 flood retention structures; cost estimate is $800,000.
17-UPPER MILL CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 82; located in Geary, Riley, Morris, and Wabaunsee Cos.; includes 15 flood retention structures; cost $3.1 million.

18-UPPER DELAWARE AND TRIBUTARIES WATERSHED PROJECT, KANSAS USDA Soil Conservation Service Flood, Land Conservation and Management	Project with application approved; planning authorization anticipated FY 94; located in Atchison, Brown, Jackson, and Nemaha Cos.; includes 120 grade stab. structures; cost $12 million.
19-DRY CREEK WATERSHED PROJECT, KANSAS USDA Soil Conservation Service Flooding	Active planning underway; installation authorization scheduled for FY 80; located in Clay, Cloud, Republic, and Washington Cos.; features 3 flood retention structures; cost $100,000.
20-ELK CREEK WATERSHED PROJECT, KANSAS USDA Soil Conservation Service Flooding and Recreation	Active planning underway; installation authorization scheduled for FY 80; located in Atchison, Jackson, and Nemaha Cos.; features 70 grade stabilization struc,; 1 multipurpose struc.; cost $7.7 mill.
21-GRASSHOPPER-COAL CREEK WATERSHED PROJECT, KANSAS USDA Soil Conservation Service Flooding	Active planning underway; installation authori zation scheduled for FY 80; located in Atchison, Brown, and Jefferson Cos.; features 39 grade stabilization structures; cost $2.6 million.
22-WOLF-WILDCAT CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding, Land Conservation and Management	Active planning underway; installation authorization scheduled for FY 80; located in Saline Co.; features 9 flood reten. structures; 12 grade stab.; cost $1.7 million.
23-SWAN CREEK WATERSHED PROJECT, NEBRASKA USDA Soil Conservation Service Flooding, Land Conservation & Management, and Recreation	Active planning underway; installation authorization scheduled for FY 80; located in Pawnee, and Gage Cos.; features 16 flood retention struc.; cost $4 million.
24-CROSS CREEK WATERSHED PROJECT, KANSAS USDA Soil Conservation Service Flooding	Project under construction; completion scheduled FY 81; located in Jackson, Shawnee, and Pottawatomie Counties; features 15 flood retention structures; cost $4 million.

25-IRISH CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding and Land Conservation and Management	Project under construction; completion scheduled FY 79; located in Pottawatomie and Marshall Cos.; features 8 flood retention; 8 grad stabilization structures; cost $2,100.000.
26-LYONS CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Recreation	Project under construction; completion scheduled post-FY 84; located in Dickinson, Geary, Marion, & Morris Cos.; features 20 flood retention, 1 multi-purpose structure; cost $4.9 million.
27-SPILLMAN CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management	Project under construction; completion scheduled FY 83; located in north-central Kan.; features 21 flood retention, 2 grade stabilization structures; cost $4 million.
28-TURKEY CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding	Project under construction; completion scheduled FY 82; located in Dickinson and Marion Counties; features 15 flood retention structures; cost $3.4 million.
29-UPPER BLACK VERMILLION WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management, Recreation	Project under construction; completion scheduled post-FY 84; located in Marshall and Nemaha Cos.; features 12 flood retention, 25 grade stab., and one multipurpose structure; cost $6.2 million.
30-NORTH BLACK VERMILLION WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation and Management, Recreation	Project under construction; completion scheduled post-FY 84; located in Marshall and Nemaha Cos.; features 22 flood retention, 35 grade stab.; and one multipurpose structure; cost $7.8 million.
31-UPPER SALT CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding	Project under construction; completion scheduled post-FY 83; located in Lincoln and Mitchell Cos.; features 39 flood retention structures; cost $7.9 million.

32-LOWER SALT CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding	Project under construction; completion scheduled FY 81; located in Lincoln, Mitchell and Ottawa Cos.; features 5 flood retention structures; cost $1.3 million.
33-UPPER WAKARUSA WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Recreation	Project under construction; completion scheduled FY 83; located in eastern Kansas; features 21 flood retention and 2 multipurpose structures; cost $6.6 million.
34-LOWER WAKARUSA WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding	Project under construction; completion scheduled FY 80; located in Douglas County; features 8 flood retention structures; 1.8 miles floodway; cost $2.5 million.
35-BIG INDIAN WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation and Management, Recreation	Operational project in Gage & Jefferson Counties; scheduled completion FY 80; features 2 grade stab.; 31 flood retention, and 1 multipurpose structure; cost $4.2 million.
36-BLACKWOOD CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding	Operational project in Hayes & Hitchcock Counties; Republican R. drainage; scheduled FY 88 completion; features 13 flood retention structures; cost $4.3 million.
37-CLATONIA CREEK WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding	Operational project in Gage & Lancaster Counties; Big Blue drainage; scheduled completion FY 82; features 8 flood retention structures; cost $1.2 million.
38-BEAR-PIERCE-CEDAR WATERSHED PROJECT, NEBRASKA USDA/Soil Conservation Service Flooding, Land Conservation and Management	Operational project in Gage County; scheduled completion FY 82; features 6 grade stab., and 27 flood retention structures; cost $3.7 million.

39-CUB CREEK WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation and Management

Operational project in Gage and Jefferson Co., Big Blue drainage; scheduled FY 82 completion; features 12 grade stabilization, 17 flood retention structures; cost $3 million.

40-LOWER MEDICINE CREEK WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding

Operational project in Lincoln and Frontier Cos., upper Republican R. drainage; scheduled completion FY 84; features 3 flood retention structures; cost $3 million.

41-UPPER MEDICINE CREEK WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding

Operational project in Hayes and Frontier Counties; scheduled completion FY 84; features 6 flood retention structures; cost $2.8 million.

42-MISSION CREEK WATERSHED PROJECT, NEBRASKA, KANSAS
USDA/Soil Conservation Service
Flooding, Land Conservation and Management

Operational project on the Nebraska-Kansas border; Big Blue basin; scheduled completion FY 80; features 4 grade stab., 12 flood retention structures; cost $2.5 million.

43-MUD CREEK WATERSHED PROJECT, NEBRASKA
USDA/Soil Conservation Service
Flooding, Land Conservation & Management, and Recreation

Operational project in Gage County; scheduled completion FY 80; features one multipurpose, 20 grade stab., 10 flood retention structures; cost $2.2 million.

FISH AND WILDLIFE

IRRIGATION

44-LITTLE BLUE UNIT FEASIBILITY STUDY, NEBRASKA
DOI/Water and Power Resources Service
Irrigation, Flooding, Fish & Wildlife, Recreation

Ongoing feasibility study for multipurpose project on the L. Blue R.; completion scheduled for FY 82; features may include reservoirs, pumping plants, and distribution system; study cost $778,000.

45-BOSTWICK DIVISION, REHABILITATION & BETTERMENT, NEBRASKA, DOI/Water and Power Resources Service Irrigation	Proposed new start rehab. & betterment project on Republican R. in south central Nebraska; will replace open laterals with pipe; cost to be determined.
46-BOSTWICK DIVISION, CONSTRUCTION, KANSAS DOI,Water and Power Resources Service Irrigation, Fish & Wildlife, Flooding	Completion of ongoing, operating irrigation project; remaining program consists of drainage works on 75,000 acres; Republican R. in Kan and Neb; total project cost $57 million; $4 million remaining.
47-FRENCHMAN-CAMBRIDGE DIVISION, CONSTRUCTION, NEBRASKA DOI,Water and Power Resources Service Irrigation	Completion of irrigation project in Nebraska's Republican River basin; remaining program is subsurface drains; total project cost $83 million; balance to complete $170,000.
48-FRENCHMAN-CAMBRIDGE DIVISION, REHAB. & BETTERMENT, NEBRASKA DOI,Water and Power Resources Service Irrigation	Ongoing construction to replace open laterals with pipe in Frenchman Unit to stabilize water supply; completion scheduled FY 81; total cost $4.4 million.
49-GLEN ELDER UNIT, FEASIBILITY STUDY, KANSAS DOI Water and Power Resources Service Irrigation, M&I Supply, F&W, Rec, Water Quality	Resumption of feasibility study for irrigation unit using existing Waconda Lake; study will begin FY 82; completed FY 85; will study construction of canals; laterals & drains; study cost $865,000.
50-SCANDIA UNIT, FEASIBILITY STUDY, KANSAS DOI Water and Power Resources Service Irrigation, M&I Supply, F&W, Rec, Water Quality	Resumption of feas. study to begin in FY 81 for irrigation on Republican R. and water supply for Belleville, Kan; involves diversion dam, pumping plants, canals, laterals; study cost $820,000.
51-LITTLE BLUE WATER RESOURCES PROJECT STUDY, NEBRASKA Little Blue Natural Resources District Irrigation Also in Platte-Niobrara Subbasin	Proposed feasibility study for a project to divert 115,000 AF of Platte R. flows to storage and delivery system in the Little Blue basin, to irrigate 40-60,000 acres; study cost $240,000; 5 yrs.

52-GROUND WATER RECHARGE-PILOT PROJECTS, KANSAS Kansas Water Resources Board Irrigation, M&I Rural Supply	New start implementation to recharge aquifers in western Kansas; program to begin in FY 80; end FY 84; funded through ground water mgmt. districts; total state funding $1 million.

LAND CONSERVATION AND MANAGEMENT

53-NORTHEAST KANSAS WATER QUALITY STUDIES USDA/Soil Conservation Service Land Conservation and Management, Water Quality Also in Middle Missouri Subbasin	New start special study in FY 80 of sediment, land treatment, and water quality in Kansas' Delaware, Nemaha & Blue Rivers and Mo. R. tribs; study cost $205,000; 5 year duration.

MUNICIPAL, INDUSTRIAL AND RURAL DOMESTIC WATER SUPPLY

54-KANOPOLIS UNIT, CONSTRUCTION, KANSAS DOI/Water and Power Resources Service & Army Corps of Eng. M&I, Rural Water supply	Proposed construction of M&I component of Kanapolis Unit; will provide water for Salina, Kan.; scheduled to begin post-1985; cost estimated at $31 million.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

POWER AND ENERGY

WATER-ASSOCIATED OUTDOOR RECREATION

55-RESERVOIR ROAD IMPROVEMENT FOR RECREATION, TUTTLE CR. RES., KS. Army Corps of Engineers Recreation	New start detailed planning studies of improved improved access roads for recreation areas at Tuttle Creek Reservoir, Kansas; scheduled FY 80-82; cost $1.1 million.

56-BONNY RESERVOIR WATER PURCHASE, COLORADO
Colorado Dept. of Natural Resources/Div of Wildlife
Recreation, Fish & Wildlife

Ongoing program wherein Colorado is proposing purchasing conservation pool at Bonny Res. on S. Fork Republican R. from DOI for fish & wildlife, rec., and other uses; total cost $1,750,000 through FY 82.

TRANSPORTATION

57-KANSAS RIVER NAVIGATION PROJECT
Army Corps of Engineers
Transportation

New start construction project to extend harbor-type navigation channel 9 miles up the Kansas R. from the mouth; schedule not determined; cost estimate $5.4 million.

WATER QUALITY

LEGAL AND INSTITUTIONAL

INSTREAM FLOWS

WEATHER MODIFICATION

58-MUDDY ROAD PROGRAM, KANSAS
Western Kansas Ground Water Mgmt. Dist. No. 1
Weather Modification

Ongoing State/Federal/local program of cloud seeding to augment rainfall and suppress hail in SW Kansas; total annual funding is approx. $600,000.

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. Bonny Reservoir, a Federal impoundment on the South Fork Republican River in Colorado, has surplus water available. Irrigable lands above and below the reservoir are in need of a water supply. It is recommended that a feasibility study be conducted by the State and local interests for supplying irrigation needs as well as other planned water uses.

B. Urban flooding is a recurring problem on the Big Blue River at Beatrice, Nebraska. Structural measures are not economically justified. The city is currently conducting a program of limited relocation and flood plain acquisition in cooperation with the Department of Housing and Urban Development to alleviate some damages. The Corps of Engineers local protection project should be deauthorized.

C. Several ongoing and recently completed planning activities deal with the Kansas Subbasin. These efforts need coordination and evaluation of their recommendations for cumulative effects. It is recommended that a level B study of the Kansas Subbasin be initiated in 1982 by Missouri River Basin Commission and affected Federal and State agencies to develop a comprehensive water resources plan for the subbasin.

CHAPTER 10

LOWER MISSOURI SUBBASIN

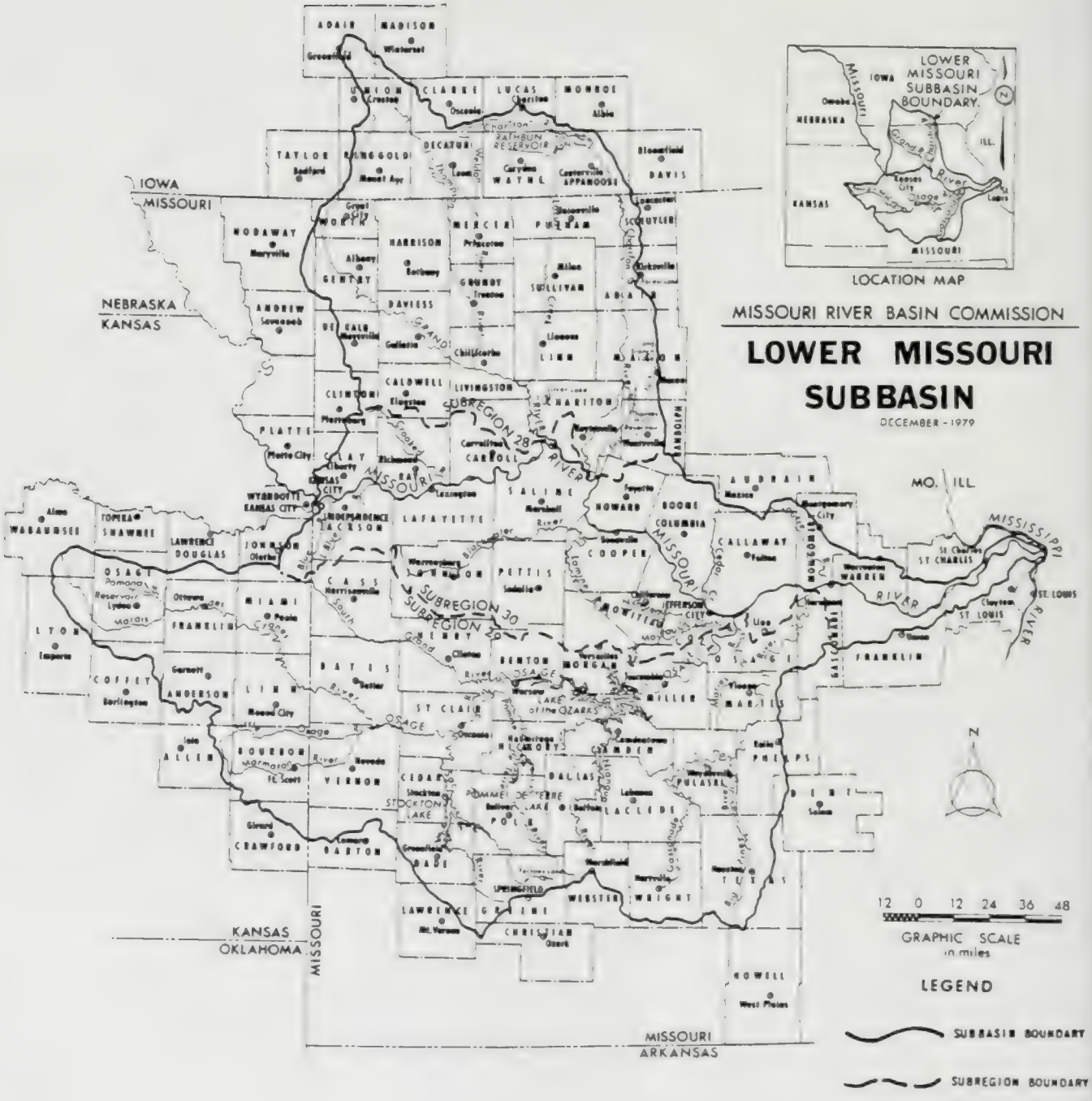
SUBBASIN DESCRIPTION

The Lower Missouri Subbasin, the furthest downstream of the Missouri River Basin subbasins, encompasses a total area of 25.4 million acres (as shown in figure 13). It includes all of the tributaries of the Missouri River from Kansas City, Missouri, downstream to the confluence of the Missouri River with the Mississippi River, 15 miles above St. Louis, Missouri. The subbasin encompasses about one-half of Missouri and small parts of Kansas and Iowa. The subbasin has a maximum east-west and north-south extent of about 300 miles.

The principal northern tributaries of the Missouri River in this subbasin, the Grand and Chariton Rivers, flow southeastward from southern Iowa where the terrain is rolling and elevations reach 1,450 feet (mean sea level). South of the main stem, the Osage and Gasconade Rivers are the chief tributaries. The Osage River system drains the land eastward from headwaters extending from the Flint Hills of east central Kansas to the Ozark foothills in south central Missouri. The Gasconade River, which lies southeast of the Osage, originates in the foothills of the Ozarks, and flows northward to the Missouri River.

Mean annual precipitation is 32 inches in south central Iowa, increasing to 42 inches in south central Missouri. About 70 percent of the precipitation occurs during the growing season, between the months of May and September. January is normally the coldest month of the year. Mean daily maximum temperatures range from 33 degrees in the north to 46 degrees in the south in January, and in July the mean daily temperature ranges from 90

Figure 13–Lower Missouri Subbasin



to 94 degrees. The freeze-free period is approximately 180 days throughout the subbasin.

Seven percent of the land acreage is in public domain, with much of the wildlife found on private land. Extensive agricultural ecosystems have replaced much of the native forest and prairie ecosystems. Wildlife habitat is of high quality where woodlands and a mixture of cropland provide favorable interspersion; all provide some of the best tree squirrel, cottontail, quail, and wild turkey hunting in the basin.

Considerable upland areas of eastern deciduous forest, largely oak, and hickory, still exist in the Ozark Plateau. Less extensive acreages occur in parts of the Grand, Osage, Missouri, and Chariton River Basins. Flood plain forests are found on bottomlands of the major streams and rivers. Forest land provides key habitat for deer, squirrel, quail, wild turkey, cottontail, raccoon and fox, and supports a few relict populations of ruffed grouse and a wide diversity of flora and fauna. Clearing of such forest land appears to be accelerating, with 1.5 million acres lost in the past decade.

Much of the tall grass prairie has been lost to cropland. Isolated acreages do still exist on private lands, mostly in the western portion of the subbasin. Three thousand acres have been acquired recently by State and private entities as wildlife habitat supporting populations of the northern greater prairie chicken, upland plover, blacktailed and whitetailed jackrabbits, and a host of other mammals, birds, and reptiles. The small white lady slipper, a plant once common to most prairies in the subbasin, is an endangered species.

Other specialized ecosystems, including caves, cliffs, and bluffs, support a variety of flora and fauna rare or unique to the Missouri River Basin. Included are the endangered Indiana and gray bats and possibly the southern bald eagle.

Aquatic resources are diverse and often of high quality, although quantity is limited. These include natural and channelized streams, multipurpose reservoirs, spring fed streams, oxbow lakes, small watershed reservoirs, fishing lakes, farm ponds, and various spring seeps and marshes.

Fishery resources of national importance exist in several waters including most of the Gasconade River Basin and certain portions of streams and reservoirs in the Osage River Basin. The

Lake of the Ozarks is nationally renowned among fishermen for large mouth bass. Cold-water trout fisheries also are of excellent quality, although limited in quantity.

The Missouri River fishery is currently dominated by channel catfish and various rough fishes, but the original array of fish fauna still exists. Various sturgeons, including the pallid, shovelnose, and lake, however, are rare, threatened, or endangered and populations of blue catfish and paddlefish have declined greatly. Some small streams such as the Niangua support exceptionally diverse fauna including the rare endemic Niangua darter. A recent study by the State of Missouri recommends that this darter be federally listed for protection under the Endangered Species Act.

Other important inhabitants of stream environments include: (1) diverse mollusk fauna in the Ozark streams; (2) various species of fur bearers, including a few river otters, documented in only a few other areas of the basin; and (3) unique vertebrate and invertebrate fauna associated with subterranean streams and springs in caves.

Few waterfowl nest in the basin, limiting both propagation and hunting. It is estimated that wetlands have declined along the Missouri River by over 10,000 acres since 1951. However, giant Canadian geese have increased in recent years under careful State management at Trimble Wildlife Refuge. Nongame species including the king rail, yellowheaded blackbird, boblink, and osprey have also been declining. Only the endangered northern bald eagle, often found wintering around reservoirs or along the Missouri River, appears to be stable or increasing in population.

Favorable climate and diversity of land forms have supported or permitted the development of a variety of natural, cultural, and historic features which attract tourists. Such important resource areas include those of (1) the Missouri River corridor with its bluffs, forests, islands, sandbars, and rich cultural and historic backdrop; (2) the Devil's Icebox and Sinkhole Plain; (3) heavily forested segments of the Gasconade and Osage, and Grand River corridors including attractive agricultural landscapes, riverscapes, and reservoirs; (4) prairie lands in the western part of the subbasin; and (5) certain free flowing streams such as the Cedar, Niangua, and Gasconade Rivers.

The subbasin's 1975 population was estimated at slightly more than 2 million, representing approximately 25 percent of the

Missouri Basin's total. Within the subbasin, 66 percent of the population (1.4 million) was urban. Two Standard Metropolitan Statistical Areas, Kansas City, Missouri-Kansas, and Columbia, Missouri are located in the subbasin. The remaining 34 percent of the subbasin's population (707,900) lived in rural areas in 1975. Demographic projections for the period 1975 to 2000 suggest that the subbasin will experience continued population growth, but at a decreasing annual rate.

Over 1 million persons were employed in the subbasin in 1975; 102,000 agricultural workers and 908,300 nonagricultural workers. Employment projections suggest the number of agricultural workers may decline by 29 percent by the year 2000, with nonagricultural employment increasing 64 percent. Total employment, therefore, should increase by 35 percent to 1.4 million by the end of this century.

A significant portion of the land in the Lower Missouri Subbasin is used for agricultural production. Major dryland and irrigated crops consist of corn, winter wheat, alfalfa, fruits and nuts, and commercial vegetables. Further, beef, pork, and dairy products contribute substantially to agricultural sales.

Forests and woodlands cover a large portion of the subbasin and commercial forestry activities are profitable.

Assorted mineral and fuel resources are mined and refined throughout the subbasin. Coal deposits are the most notable. Manufacturing consists largely of processing food. Other manufacturing activity includes fuels, printing, and paper products.

Natural outflow from the Missouri River Basin was calculated in 1971 to be about 65 million acre-feet. Based upon this total and accounting for State estimates of depletions, 1975 average annual remaining out flows were estimated to be 49.5 million acre-feet. Future flows at Hermann, Missouri, near the mouth of the Missouri River are predicted to decline to a level of 46 million acre-feet by 1985 and to 42 million by the year 2000.

Water withdrawals within the Lower Missouri Subbasin are moderate, considering available flows. Cooling at steam electric power plants is the purpose for which the largest water withdrawals are made. However, consumptive use of water is minimal, with livestock and municipal and industrial uses accounting for about two-thirds of the total 177,000 acre-feet per year.

Overland runoff contributes large amounts of silt and organic material to streams throughout the subbasin. In reaches of the Osage, Marias de Cygnes, Grand, Chariton, and Blue Rivers, dissolved oxygen levels during occasional periods of low flow drop below desirable levels for propagation of aquatic life.

Water quality in valley fill aquifers lying along the Missouri River and its tributaries appears to improve in the downstream direction, probably because of progressively increasing average annual precipitation.

PROBLEMS AND OPPORTUNITIES

The principal problems in the Lower Missouri Subbasin are nonpoint source pollution; potential power shortages given expected future demands; and uncertain water supplies for coal gasification and other potential energy development. Others of lesser impact include local ground water supplies of unacceptable quality in some parts of the subbasin; isolated flood problems; overcrowded recreation areas; declining acreage of wetlands and forests; and riparian habitat impaired by continuing development. The basin is just beginning to explore the opportunities available through modern irrigation practices, and coal gasification is possible, given the coal deposits available in some areas.

Nonpoint source pollution is the most serious problem in the Lower Missouri Subbasin. This problem results from agricultural runoff, urban storm water drainage, acid mine drainage, and individual waste disposal systems.

In north and west central Missouri and in southern Iowa, active bank erosion is common and heavy sediment loads are consequently carried by many Missouri River tributaries. Steep slopes and soil types cause upland soil erosion, especially in northwestern Missouri and southwestern Iowa. The productive cropland soils in the South Grand, Blackwater, Grand, and Chariton Basins are primarily of loess or loess over glacial till and are often tilled.

Due to the rolling topography, annual soil loss on unprotected tilled cropland often exceeds 25 tons per acre. This loss is five times the rate of loss allowable to maintain sustained crop production and also is a major contribution to

nonpoint water pollution. Storm water runoff in several of the subbasin's metropolitan areas periodically adds to nonpoint source pollution.

Mine drainage, (including suspended solids and acid wastes), has been responsible for pollution on Cedar Creek; Locust Creek; lower east fork of the Chariton River; and the Chariton River in Putnam, Schuyler, Sullivan, and Adair counties. A major problem has occurred on the east fork of the Chariton River with acid mine drainage in the Macon-Randolph county area. In Boone, Callaway, Henry, and St. Clair counties, acid water from abandoned strip mines is a problem. Inactive strip mines developed prior to 1973 are not covered by State reclamation laws.

Rapid growth in urban and recreational areas has caused development beyond sewage collection lines resulting in increasing use of individual septic tanks, in turn contributing to nonpoint source pollution. No coordinated regionwide water delivery systems currently exist. Solution of the problem is further hampered by restrictions imposed or interpreted by the Farmers Home Administration that prevent the design of rural water and wastewater disposal systems for future expansion.

Power and energy is another area presenting problems in the Lower Missouri Subbasin. A number of proposals have been advanced by private industry for development of coal and electric power, and several lowhead hydro sites have been investigated. Projected power demands will necessitate installation of additional power plants in the subbasin, and there are opportunities for additional hydroelectric generation at existing projects or at potential sites.

Coal gasification is possible in the Grand River Basin in north-central Missouri, if water supplies are sufficient, and along the Missouri River in central Missouri where there are considerable reserves of high sulphur coal.

Tar sands in Bates, Vernon, and Barton counties possess potential for energy production, but water requirements for processing the sands are presently unknown. In all cases, attendant environmental problems would have to be addressed.

Local ground water of poor quality occurs in north and west central Missouri. There is strong potential for building rural water systems utilizing high quality surface water,

especially from the Missouri River, and, in some areas, the reallocation of water in Federal reservoirs may be possible. As more rural water supply systems are built or as existing systems increase their service areas, coordination between systems could reduce costs and the need for additional facilities and water.

The Grand River Basin has significant flood problems. Recurring flooding seriously hampers cropping and capital improvements in the flood plains. Annual flooding in the Grand River Basin affects some 370,000 acres, 80 percent of which is farmland. Flooding also occurs in the Chariton, Marais des Cygnes, Osage, and Fishing River Basins.

Problems with urban flooding occur in the subbasin's metropolitan areas and is especially noticeable along flood plains on many streams that flow through developed areas.

More leisure time has allowed subbasin residents to spend more time in recreational pursuits or to expand their interest in natural, historical, or cultural resources. As the public seeks outlets for their activities, existing recreational facilities become overtaxed and a lack of additional facilities exists in certain areas of the basin. Access to water-oriented recreation areas along the Missouri River and Marias des Cygnes Basin is limited.

Wetlands and forest land acreages are declining in the flood plains. Wetlands have been converted to agricultural or urban uses. Drainage of wetlands may also reduce flood storage capability, nutrient retention, and ground-water recharges.

On the Missouri River, channel improvements have reduced backwater areas, islands, and sandbars. Elsewhere, on tributaries such as the Grand, South Grand, Chariton, and Blackwater Rivers, channel straightening has reduced riparian habitat. All such action reduces the habitat of fish and wildlife.

Irrigation development is a relatively new opportunity in this particular subbasin compared to the other subbasins of the Missouri River Basin. Irrigation has been limited so far, but the opportunity exists to conduct research in irrigation in this subbasin in an effort to overcome difficulties being experienced elsewhere.

PLANNING OBJECTIVES

The States in the Lower Missouri Subbasin, Iowa, Kansas and Missouri, recognize the need for continued refinement of State water planning, In addition, the need for level B planning for the entire subbasin is recognized and specifically recommended later in this section.

To address flooding problems in ths subbasin, Iowa stresses prevention of damage to lands through small projects or nonstructural means whereas long range goals in Kansas are directed more toward reduction of flooding through structural means. Both Kansas and Missouri call for nonstructural alternatives in flood control, although both will consider structural or nonstructural combination measures for flood damage abatement on a case by case basis.

In Iowa, streams designated by the Iowa Conservation Commmission as having exceptional recreation and fish and wildlife uses are of primary concern. The State recommends raising protected low flows and provides for strict regulation of water withdrawals and channel changes.

Policies toward municipal, industrial, and rural domestic water supplies in the three States are surprisingly different. The State of Iowa actively encourages water conservation measures. The State of Missouri has implemented training and technical assistance programs, monitors water quality, and reviews construction plans. The State of Kansas policy calls for provision of suitable, sufficient, reliable water supplies for present and future uses within the State, including the development of adequate water supplies for small communities and rural users.

Iowa power and energy development Iowa policies call for location of plants on the major streams bordering the State rather than permitting ground water use for this purpose. Kansas water and energy policies have accorded hydroelectric power development in eastern Kansas a low priority because further development is limited by the terrain and because of higher priorities for water use for more beneficial purposes.

Iowa's objectives in water-related transportation reflect the State's recognized dependence on the Federal Government to finance and maintain the navigation on the Missouri River. Missouri's policy favors greater use of navigable waterways including port development.

Iowa maintains a strong interest in allocation of instream flows and water resources throughout the Missouri River Basin. The State's intent is to ensure that Iowa receives its share for water supply needs and instream uses such as navigation. Missouri intends to consider the need for and desirability of establishing a permit system for water use, with provision for maintaining adequate quality and quantity of water for nonconsumptive uses.

PLAN OVERVIEW

The plan for the Lower Missouri Subbasin includes the recommendations presented in this chapter, the basinwide programs recommended in chapter 2, and the statewide programs recommended for Iowa, Kansas and Missouri, also found in chapter 2.

While the plan for the Lower Missouri Subbasin effectively addresses many of the problems and opportunities cited above, the great number of Federal and State planning efforts in the subbasin points to the need for a closely coordinated comprehensive planning effort. An important recommendation for this subbasin is, therefore, for the initiation of a level B study to cover the entire subbasin.

Some small watershed projects are recommended in the subbasin. In general, however, rural flooding problems remain unaddressed. Most structural flood control items such as dam levees and large scale channelization are not feasible, and use of the flood plain for cropland continues. In addition, adequate funding for small watershed programs is not available and the backlog will continue for many years.

The importance of water transportation on the Missouri River is recognized by an ongoing Corps program assigned to improve the navigation channel. Another Corps program, Missouri River Fish and Wildlife Mitigation Study, is a major effort to provide compensation for loss of habitat by construction, operation, and maintenance of navigation, habitat improvement and replacement. Several statewide soil conservation studies examine land conservation and management, and management of erosion and sediment problems.

Development of national historic trails such as Lewis and Clark, Mormon, Pioneer, and Oregon is considered important in this subbasin. The plan suggests that development of these trails be integrated with compatible water-associated outdoor recreation projects.

RECOMMENDED PROGRAMS - LOWER MISSOURI

NAME, LEAD AGENCY, AND FUNCTIONS	DESCRIPTION
COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES	
1-STATEWIDE RIVER BASIN STUDY, MISSOURI USDA/Soil Conservation Service Comprehensive Also in Middle Missouri Subbasin	New start special study beginning in FY 82; statewide comprehensive study in water and land resources; involves SCS, ESCS & FS; study cost $925,000.
2-NORTHERN MISSOURI TRIBS COOPERATIVE STUDY/MISSOURI AND IOWA USDA/Soil Conservation Service Comprehensive Also in Middle Missouri Subbasin	Ongoing river basin planning thru FY 82; eleven reports completed; develop alternate plans on major streams; study cost $2.2 million.
3-SOUTHWEST IOWA WATER RESOURCES STUDY Iowa Geological Survey Comprehensive Also in Middle Missouri Subbasin	New start data collection & research beginning in FY 82; water supply availability study in S.W. IA; study cost $750,000.
4-KANSAS AND OSAGE RIVERS STUDY, KANSAS Army Corps of Engineers Comprehensive Also in Kansas Subbasin	Ongoing special study thru FY 83; streambank stabilization on KS River & tribs, mineral pollution control in KS River Basin & additional water supply & distrib. in KS & Osage; study cost $4.5 million.
5-SOUTHERN IOWA RC&D AREA, IA USDA/Soil Conservation Service Comprehensive Also in Middle Missouri Subbasin	Ongoing feasibility study thru FY 82; Adair, Adams, Taylor, Ringold, Decatur, Wagner & Clark counties; cost $2.1 million.

6-CHARITON RC&D AREA, IOWA USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study thru FY 82; Wayne & Appanoose counties, others not in MRB; cost $590,000.
7-LAKE REGION RC&D AREA, KS USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study thru FY 82; Anderson, Coffey, Franklin, Linn, Miami & Osage counties; cost $577,000.
8-GREEN HILLS RC&D AREA, MO USDA/Soil Conservation Service Comprehensive	Ongoing feasibility study thru FY 82; Harrison, Mercer, Putnam, Daviess, Grundy, Linn, Sullivan, Caldwell & Livingston counties; cost $1.5 million.

FLOODING

9-FLOOD PLAIN MANAGEMENT PROGRAM FOR THE MISSOURI RIVER Missouri River Basin Commission Flooding Also in Middle Missouri & Eastern Dakotas Subbasin	New start special study beginning in FY 81; Missouri River mainstem from near Sioux City, Ia, to the mouth near St. Louis, Missouri; study cost $400,000.
10-MISSOURI RIVER LEVEE SYSTEM Army Corps of Engineers Flooding Also in Middle Missouri Subbasin	Ongoing program implementation detailed study thru 81; flood protection main stem Sioux City, Iowa to mouth; active L385, L330-345, L329-319; cost FY 81 $6.7 million; bal to complete $85.3 million.
11-BLUE RIVER CHANNEL, KANSAS CITY, MISSOURI Army Corps of Engineers Flooding	Ongoing program implementation thru FY 84; twelve miles of modified channel Jackson County; cost $93.9 million.

12-LITTLE BLUE RIVER CHANNEL, MISSOURI Army Corps of Engineers Flooding	Ongoing program implementation thru FY 82; channel and levee improvements in conjunction with upstream Little Blue River Lakes; Jackson County; cost $26.8 million.
13-LITTLE BLUE RIVER LAKES, MISSOURI Army Corps of Engineers Flood, F&W, Rec., Water Qual.	Ongoing program implementation thru FY 85; Longview Lake and Dam, Jackson County, Lee's Summit, Little Blue River, Grandview, Kansas City, Missouri; cost $129 million.
14-WEARS CREEK PHASE II, JEFFERSON CITY, MISSOURI Army Corps of Engineers Flooding	New start beginning in FY 81; flood protection within boundaries of urban renewal project adjacent to State capitol complex; cost $36 million.
15-LONG BRANCH LAKE, MISSOURI Army Corps of Engineers Flood, M&I Rural Supply, Rec., Water Qual., F&W	Ongoing program implementation thru FY 81; East Fork of Little Chariton River, west of City of Macon; cost $21.5 million.
16-STOCKTON LAKE, IMPLEMENTATION OF DOWNSTREAM MEASURES, MO Army Corps of Engineers Flood, F&W, Energy, Rec.	Deferred program implementation; litigation; Cedar, Dade, Polk counties; Sac River downstream from Stockton Dam to reduce downstream damage.
17-HARRY S. TRUMAN DAM AND RESERVOIR, MISSOURI Army Corps of Engineers Flood, F&W, Energy, Rec.	Ongoing program implementation thru FY 82; Benton, Bates, Henry, Hickory, St. Clair & Vernon counties; cost $469 million.

18-LOWER GRAND RIVER LEVEE SYSTEM Army Corps of Engineers Flooding	New start implementation study for a levee system to provide a 50 year level of flood protection along the Grand River downstream of Yellow Creek; FY 84 completion; construction estimate $30.9 million, local share $390,000.
19-FORT SCOTT LAKE RESTUDY, KANSAS Army Corps of Engineers Flooding	Deferred feasibility study thru FY 82; flood control, water supply and recreation on Marrnaton River; Bourbon County; cost $1.2 million.
20-HILLSDALE LAKE, KANSAS Army Corps of Engineers Flood, F&W, M&I Rural Supply, Rec., Water Qual.	Ongoing program implementation thru FY 82; multipurpose reservoir, Big Bull Creek; Miami County; cost $59 million.
21-BLACKBIRD-WILDCAT WATERSHED PROJECT, IOWA, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Appanoose County, Iowa and Putnam & Adair counties, Missouri, recommended for planning FY 82; project envisions 4 flood detention struc. & 25 grade stabilization struct.; cost $1.4 million.
22-EAST FORK OF GRAND RIVER, WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Ringold & Union counties; recommended for planning; project envisions 5 flood detention structures; cost $4.5 million.
23-LONG CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Dacatur & Clarke counties; recommended for planning; project envisions 4 flood retention structures; cost $3.4 million.
24-MEDICINE CREEK WATERSHED PROJECT, IOWA, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Wayne County, Iowa and Mercer & Putnam counties Missouri; recommended for planning FY 84; project envisions 4 flood detention struct. & 20 grade stabilization structures; cost $1.2 million.
25-UPPER POTTAWATOMIE WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Anderson, Franklin & Coffey counties; recommended for planning FY 96; project envisions 15 flood detention structures; cost $4.8 million.

26-LOWER POTTAWATOMIE WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Anderson, Franklin, Miami & Linn counties; recommended for planning; project envisions 30 flood detention structures; cost $5 million.
27-TAUY WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Douglas & Franklin counties; recommended for planning FY 88; project envisions 8 flood detention structures and one multipurpose structure; cost $2.3 million.
28-CROOKED RIVER WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Clinton, Caldwell, Clay, & Ray counties; recommended for planning FY 84; project envisions 10 flood detention structures and 35 grade stabilization structures; cost $4.2 million.
29-BIG CREEK, HURRICANE WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Livingston & Carroll counties; recommended for planning FY 81; project envisions 8 flood detention structures; and 40 grade stabilization structures; cost $3.5 million.
30-BEE BRANCH WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Linn & Chariton counties; recommended for planning post FY 84; project envisions 2 flood detention structures and 2 miles levee; cost $1.4 million.
31-MIDDLE FORK CHARITON RIVER WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Macon & Randolph counties; recommended for planning post FY 84; project envisions 6 flood detention structures and 10 grade stabilization structures; cost $1.9 million.

32-MONITEAU CREEK WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Randolph, Howard & Boone counties; recommended for planning post FY 84; project envisions 10 flood detention structures and 15 grade stabilization structures; cost $2.8 million.
33-SALT CREEK-GARDEN OF EDEN WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Chariton County; recommended for planning post FY 84; project envisions 2 flood detention structures and 20 miles of channel; cost $2.8 million.
34-EAST YELLOW CREEK WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Sullivan, Linn & Chariton counties; recommended for planning in FY 82; project envisions 5 flood detention structures and 30 grade stabilization structures; cost $2.4 million.
35-EAST LOCUST CREEK WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Putnam & Sullivan counties; recommended for planning in FY 82; project envisions 3 flood detention structures and 20 grade stabilization structures; cost $1.8 million.
36-UPPER LOCUST CREEK WATERSHED PROJECT, IOWA-MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Wayne & Appanoose counties, Iowa and Sullivan & Putnam counties,Mo;recommended for planning FY 82; project envisions 10 flood construction & 45 grade stabilization struct.; cost $4.2 million.
37-WEST FORK OF BIG CREEK WATERSHED PROJECT, IOWA-MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Ringold & Decatur counties, Iowa & Harrison & Daviess counties, Missouri; planning underway FY 81; project envisions 8 flood detention struct. & 35 grade stab. struct. cost $6.4 million.
38-EAST FORK OF BIG CREEK WATERSHED PROJECT, IOWA-MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Decatur County, Iowa & Harrison Co. Missouri; under construction; to be completed FY86; project envisions 2 flood detention structures and 11 grade stabilization structures; cost $555,000.

39-LITTLE RIVER WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Decatur County; construction to begin FY 90; project envisions 6 flood detention struct. and 1 multipurpose structure; cost $5.2 million.
40-THREE-MILE CREEK WATERSHED PROJECT, IOWA USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Adair & Union counties; construction to begin FY 85; project envisions 4 flood detention structures, 27 grade stab. structures & 1 multipurpose structure; cost $7 million.
41-MIDDLE CREEK WATERSHED PROJECT, KANSAS USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Linn & Miami counties; construction to begin post FY 84; project envisions 7 flood detention structures & 1 multipurpose structure; cost $2.4 million.
42-WILLOW CREEK WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Ray County; construction to begin FY 84; project envisions 3 flood detention structures & 10 grade stabilization structures; cost $1.8 million.
43-CALLAHAN CREEK WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Boone county; under construction; project envisions 7 flood detention structures; cost $1.4 million.
44-GRINDSTONE, LOST, MUDDY CREEKS WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Gentry, Daviess, Dekalb & Clinton counties; construction to begin FY 88; project envisions 24 flood detent. struct., 33 grade stab. struct. & 3 multipurpose struct.; cost $6.2 million.
45-SOUTH FORK OF BLACKWATER WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Johnson County; under construction; project envisions 7 flood detention structures, 14 grade stabilization structures & 1 multipurpose structure; cost $5.3 million.

46-LITTLE SNI-A-BAR WATERSHED PROJECT, MISSOURI USDA/Soil Conservation Service Flooding, Land Conservation & Management	Watershed in Lafayette County; under construction; project envisions 2 flood detention structures & 16 grade stabilization structures; cost $3.2 million.

FISH AND WILDLIFE

47-MISSOURI RIVER FISH & WILDLIFE MITIGATION STUDY Army Corps of Engineers F&W Also in Middle Missouri Subbasin	Ongoing special study thru FY 81; all counties bordering main stem Missouri, NE, IA, KS, MO; compensation for F&W loss & habitat improvement; cost $273,000.

IRRIGATION

LAND CONSERVATION AND MANAGEMENT

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

48-SMITHVILLE LAKE, MISSOURI Army Corps of Engineers M&I Supply, Flood, F&W, Rec., Water Qual. Also in Middle Missouri Subbasin	Ongoing program implementation of a multi-purpose lake for water supply, flood control, fish and wildlife, recreation and improved water quality; total cost $83.7 million.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

POWER AND ENERGY

WATER-ASSOCIATED OUTDOOR RECREATION

49-MELVERN AND POMONA LAKES-ROAD IMPROVEMENT, KANSAS Army Corps of Engineers Recreation	New start implementation study thru FY 83; Osage County; recreation access road planning; cost $500,000.

TRANSPORTATION

50-MISSOURI RIVER NAVIGATION, BANK STABILIZATION CONTROL PROG. Army Corps of Engineers Transportation, Recreation Also in Middle Missouri	Ongoing program implementation thru FY 83; main stem Missouri River from Sioux City to mouth, NE, IA, KS, MO; improve navigation channels, bank erosion & stab., rec. facil.; cost $438 million.

WATER QUALITY

LEGAL AND INSTITUTIONAL FACTORS

INSTREAM FLOWS

WEATHER MODIFICATION

CONCLUSIONS AND ADDITIONAL RECOMMENDATIONS

A. The Lower Missouri Subregion has a number of pressing water-related problems that need to be resolved within the next 15 years. A comprehensive analysis of this subregion is needed, as evidenced by the number of single or multiple purpose studies recently completed or currently underway within the area by the Corps of Engineers, Department of Agriculture, Department of the Interior, State of Missouri, and Mid-America Regional Council (MARC). A Level B study of Lower Missouri Subbasin would bring plans and proposals together for compatible solutions to the problems, and should be initiated by 1983.

B. Nonpoint source pollution is one of the most serious problems in the Lower Missouri subbasin. To address the problem, it is recommended that the Rural Clean Water Program (Section 208(j)) of the Clean Water Act of 1977, which would control agricultural related nonpoint sources of pollution on private rural lands, be funded and implemented.

C. Storm water runoff in some Missouri metropolitan areas adds to nonpoint source pollution. Programs to alleviate the problem already exist in the Kansas City and St. Louis areas and should be initiated in the Springfield area.

D. Suspended solids and acid wastes from mining operations cause major problems in many parts of the Lower Missouri Subbasin. Information should be developed to accurately predict results of corrective measures to aid in making the measures more cost effective. Also, research should be conducted to analyze effects of various levels of pollution abatement.

E. Urban sprawl areas and recreation oriented areas have rapidly grown beyond sewage collection lines, resulting in the use of individual septic tanks and contributing to nonpoint source pollution. Coordinated regionwide water delivery systems are needed. Limitations and interpretation of the Farmers Home Administration programs restrict rural water and waste water disposal systems to accommodate new rural users and to improve the systems through consolidation. States should work toward removing these limitations.

F. The Lower Missouri Subbasin lacks adequate data on land use and water needs necessary for proper planning and management. A study to obtain such information is recommended. The need for land use and water related program planning is particularly needed in Iowa.

G. Projected power demands will necessitate construction of additional power plants in the subbasin. Resources are available for additional power generation, but attendant environmental problems and adequacy of sufficient water supplies remain to be determined.

H. Existing recreational facilities are overtaxed, and a lack of facilities exists in certain areas of the subbasin. Also, access for water-oriented recreation along the Missouri River and Marias des Cygnes Basin is limited. One possible solution is additional development of recreation at Federal reservoirs. State constitutions prevent the future commitment of funding needed to obtain cost sharing for recreation purposes as required by section 221, 1974 Flood Control Act. It is recommended that the States work with their respective Federal congressional delegations to amend the law and to develop workable cost sharing for recreational facilities on Federal reservoirs.

CHAPTER 11

FINAL ENVIRONMENTAL IMPACT STATEMENT

ABSTRACT

The Missouri River Basin Water Resources Management Plan is a guide for the development, conservation, preservation, and management of water and related land resources in the Missouri River Basin. It was prepared by the Missouri River Basin Commission and includes about 550 data collection, research, special study, river basin planning, feasibility study, and implementation programs. The plan was developed by State-Federal subbasin planning teams in accordance with State and Federal planning objectives and policies to address identified water resources problems and opportunities. The environmental impact statement focuses on the qualitative effects of implementation programs in the plan and reflects an analysis that matches the level of detail addressed in planning. The impacts of the programs and projects are discussed according to the functional categories used in development of the plan.

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SUMMARY

This environmental impact statement was prepared under direction of the Missouri River Basin Commission's Planning Committee to analyze the environmental effects of the Missouri River Basin Water Resources Management Plan. It is intended to meet the procedural requirements of the National Environmental Policy Act of 1969, and subsequent implementing regulations of the Council on Environmental Quality and the Water Resources Council.

Historically agriculture has been most important in the economy and to the people of the Missouri River Basin, with energy development also becoming very important in recent years. This has led to expression of concern over the adequacy of surface and ground water resources to meet the water demands for all, often conflicting, uses. Additional concern over the environmental impacts of increased intensity of water and related land resources use has also grown. The water resources plan was developed to respond to these concerns and to provide a guide for the development, conservation, preservation, and management of the water and related land resources in the Missouri River Basin. The plan identifies some 550 programs to address and meet future water resource management needs and opportunities.

The environmental impact statement focuses on the qualitative effects of implementation programs in the plan and reflects an analysis that matches the detail addressed in planning. Actions, identified according to functional areas, were grouped and analyzed for broad types of impacts expected or likely to occur. In the past this analysis relied upon detailed impact information developed by the implementation agency during prior feasibility studies, impact information developed by the Commission in recent level B studies, or other resource studies at the regional or national level. The general impacts of each functionally-related group of actions were then determined from a basinwide perspective.

The net overall effect of the regional water and related land resources plan on the human environment will be beneficial. Long term agricultural productivity will be maintained and improved; in addition, improved water resources management will encompass a wider range of beneficial uses and stimulate an improvement in the efficiency of its use. Future development of the Basin's energy resources is not precluded and water quality

is to be preserved or enhanced to protect human health and fish and wildlife resources. Certain plan elements will improve the management of fish and wildlife resources, protect natural, historic and cultural areas, and improve public access to important recreational resources. Human occupancy of hazardous portions of the flood plain will be discouraged and structural protection of valuable flood plains already developed is contemplated in those instances where reliance on nonstructural approaches will not work. Certain irreversible and irretrievable commitments of resources associated with plan implementation are also identified.

PURPOSE OF AND NEED FOR ACTION

The Missouri River Basin Water Resources Management Plan was prepared through the joint efforts of the 23 State, Federal, and interstate members of the Missouri River Basin Commission as well as numerous other concerned agencies and individuals. The plan will serve as a guide for the development, conservation, preservation, and management of water and related land resources in the Missouri River Basin. It is the product of extensive interagency and interstate cooperation and collective judgment and therefore, a reliable guide for programming and budgeting for all levels of government. The recommendations in the plan are intended to support the Congress, the Federal Government, and States in programming, budgeting, and funding water resources programs and projects in the Missouri River Basin. The environmental effects of the plan have been determined in accordance with the National Environmental Policy Act of 1969 and subsequent implementing regulations of the Council on Environmental Quality (40 CFR, Parts 1500 through 1508) and the Water Resources Council (18 CFR, Part 707).

Section 707.8 of the Water Resources Council's regulations indicates that regional water resource plans normally require an environmental impact statement. Sections 707.5 and 707.9 of the regulations require the environmental statement to reflect the level of planning carried on during the study and to address those environmental considerations and alternatives relevant to decisionmaking at that level. Through this process, generally known as tiering, the level of detail in the analysis was reduced through the development of broad environmental impact information relating to groups of actions categorized according to function in the regional plan. Environmental assessments or impact studies previously conducted at nationwide, level B, or level C planning levels provided a basis for this analysis, and the

impact information was re-evaluated in terms of its significance within the planning area (Missouri River Basin). Environmental assessment and impact information developed during level B studies (Platte Basin, Yellowstone Basin and Adjacent Coal Areas, and Upper Missouri), nationwide programmatic studies (National Flood Insurance Program, Federal Aid in Fish and Wildlife Restoration Program) or regional programs (Missouri River Navigation and Bank Stabilization Program) were particularly valuable. Because this EIS reflects broad environmental concerns, detailed impact information should be gathered from project EIS's developed by the implementing agency, available for many plan elements. For those projects where an EIS has not yet been prepared, their preparation may be underway or programmed depending on the progression of project plans. Individuals and agencies should utilize available review opportunities in these EIS's to express their concerns and opinions. Broad categories of issues which these EIS's should consider are identified in the "Future Environmental Responsibilities" section.

The scoping process, described in Section 707.11 of the Water Resources Council regulations, was utilized to reduce the range of actions which should be addressed. Through this mechanism, it was determined that the analysis should focus on implementation programs rather than on resource assessment or feasibility studies which have few if any direct environmental impacts. This eliminated the need to address in detail some 210 plan elements.

For the purpose of this environmental impact statement, therefore, the environmental analysis is directed toward implementation programs, and in addition, reflects an analytic level which matches the level of detail addressed during basinwide planning. The impacts of the programs and projects are also discussed in accordance with the functional categories used in development of the regional plan.

ALTERNATIVES INCLUDING PROPOSED ACTION

The Missouri River Basin Water Resources Management Plan is a compilation of approximately 550 data collection, research, special study, river basin planning, feasibility study, and implementation programs. Programs are identified as basinwide, statewide, or subbasin based upon the extent of the program. Basinwide programs affect several or all of the eight subbasins; statewide programs affect an entire state; and subbasin programs generally only one subbasin.

There are approximately 340 implementation programs identified in the plan. The 33 flooding projects are generally the responsibility of the Corps of Engineers. There are about 200 small watershed projects recommended for Soil Conservation Service implementation with assistance from State and local entities. The Water and Power Resources Service is responsible for 28 irrigation projects that include municipal and industrial water supply, energy, fish and wildlife, and recreation purposes. The remaining functional areas account for the balance of the some 80 projects to be implemented by various Federal, State, and local agencies.

Each of the programs in the plan underwent considerable evaluation by State-Federal subbasin planning teams who were responsible for reviewing each ongoing, planned, and potential water resources program. This was done to determine if the planning objectives and policies were being achieved. In addition, each program was evaluated with respect to compatibility with other programs. All recommended programs were evaluated with respect to their collective adequacy and effectiveness at addressing identified problems and opportunities. Where necessary, additional alternatives, including no actions, were discussed, evaluated, and recommended. Throughout this process, all participants contributed to the identification of local problems and opportunities, and to alternatives acceptable to local interests. This was an important aspect of the regional planning effort because many local projects have already been evaluated, analyzed according to NEPA requirements, and agreed to locally by affected people. The proposed action is therefore a compilation of programs which conserve, utilize, develop, and manage the Basin's water and related land resources, and which have been heavily influenced by local interests.

AFFECTED ENVIRONMENT

The Missouri River Basin encompasses one-sixth of the contiguous land area of the United States, draining 328.5 million acres within the United States and about 6.2 million acres in Canada. It includes all of the State of Nebraska; most of Montana, South Dakota, and Wyoming; about half of Kansas, Missouri, and North Dakota; and smaller parts of Colorado, Iowa, and Minnesota. The Missouri River, formed by the junction of the Jefferson, Gallatin, and Madison Rivers in Montana, flows generally southeastward 2,315 miles to its junction with the

Mississippi River above St. Louis, Missouri. Tributaries include the Milk, Yellowstone, Little Missouri, Cheyenne, Niobrara, James, Big Sioux, Platte, Kansas, Grand, and Osage Rivers. The three major physiographic divisions within the Basin are the Rocky Mountain System, the Interior Plains, and the Interior Highlands. The Rocky Mountain System is an area of exceptionally rugged topography with deep stream valleys, high plateaus, clear alpine lakes, and high mountain peaks. Cold water streams in this area provide high quality fishery habitat. The vegetation varies from alpine tundra and coniferous forests in the higher elevations to brushlands and grasslands in the intermountain valleys. The Interior Plains range from flat to rolling or hilly topography which was originally dominated by grassland vegetation. This area is dissected by intermittent or perennial warm water streams and rivers. The fishery habitat of these waters varies from good to poor depending upon water flows, substrate, chemical characteristics, and numerous other parameters. Riparian woodlands have developed along these streams where ecological conditions have been favorable. The Interior Highlands is topographically diverse and dissected by many productive warm water streams. The vegetation is also diverse and in its natural state was dominated by the eastern deciduous forest.

Approximately 298 million acres or 92 percent of all the land in the Basin is used for agricultural purposes. More than half of the agricultural land is used for pasture and rangeland. Irrigated cropland comprises 11.4 million acres or about 4 percent of the present agricultural total with irrigated acreage expected to increase approximately 50 percent by the year 2000.

The economy of the Basin has historically been dominated by agriculture, but the region has also produced metallic and precious minerals, timber products, fuel products, and electric power. Recently, substantial increases in mining, manufacturing, and recreation-tourism have served to further strengthen and diversify the economic activities.

While the Missouri River Basin has an overall adequate supply of surface and ground water resources, distribution of this water in space and time often does not meet local or regional demand. Hence, seasonal shortages occur in several areas. In addition, the quality of the water resources is highly variable, which aggravates the water supply problem for many users.

Detailed descriptions of the Basin and the subbasins are provided in Chapter 2 and Chapters 3 to 10 of the plan, respectively.

ENVIRONMENTAL CONSEQUENCES

Impacts of Proposed Actions

The discussion of impacts in this section generally follow the classification adopted for development and display of the plan. These categories are:

- Comprehensive Planning and Support Activities
- Flooding
- Fish and Wildlife
- Irrigation
- Land Conservation and Management
- Municipal, Industrial, and Rural Domestic Water Supply
- Natural, Historic, and Cultural Resources and Water-Associated Outdoor Recreation
- Power and Energy
- Transportation
- Water Quality
- Legal and Institutional Factors
- Instream Flows
- Weather Modification

Comprehensive Planning and Support Activities

Several Federal studies or assistance programs will improve decisionmaking and lead to the development of improved programs for the management of the Basin's water and related land resources. Therefore, over the long term, they will indirectly improve the productivity, conservation, or utilization of forest, range, soil, and wildlife resources, and increase the efficient use and conservation of scarce water supplies. In addition, the Federal dam inspection program will enable water resource managers to develop actions and programs which, when implemented, will reduce potential hazards to the human environment in flood plains throughout the Basin.

Flooding

Collectively, the recommended implementation programs will have a beneficial effect on the human environment because they will: (1) reduce the frequency, intensity, or extent of flooding

in flood-prone reaches of river valleys; (2) reduce probabilities of future flood-related disasters through improvement of State and Federal flood plain management programs; (3) discourage the hazardous uses of flood plains through Federal leadership in following the goals of Executive Order 11988; (4) increase focus on methods to more equitably share the responsibilities of flood plain management among Federal, State, and local governments; and (5) increase focus on management alternatives maintaining the full range of natural and beneficial uses of flood plains.

A number of Federal flood control projects, some ongoing, are recommended to reduce flood damages in large urban areas along major streams (Kansas City, Sioux City, Great Falls, and Denver), where extensive flood plain encroachment has occurred over the past century. Impacts related to these projects are associated with bridge removal and relocation, channel modification, levees, or small dams. In general NEPA-related analyses for these projects have indicated that most natural values associated with riverine environments in these larger urban areas have already been lost. As a result, further project related impacts were not considered to be adverse or cumulatively significant. While exclusive use of nonstructural alternatives was not feasible, several elements (local zoning and regulation, flood proofing, and development of emergency plans) have been adopted as part of a comprehensive flood control and management strategy in each of these urban areas.

In small urban or rural areas, often along smaller rivers, the projects may affect stream habitat and other natural values. In these instances additional planning has been conducted to minimize or mitigate adverse impacts. Impacts are related to those associated with construction of levees, small impoundments, or channel modification.

Federal and State flood plain regulatory and monitoring programs will have a significant effect in preventing the development of future hazardous and nuisance uses, and will discourage some existing hazardous uses of flood plains. These programs, in concert with planned flood control efforts, will tend to check or deter potential for increased damages in urban areas that is often related to inflationary increases in values. Along major rivers where suitable non-flood plain land for development is not available, or navigation-related developments are needed, additional planning is necessary to prevent hazardous uses or to mitigate any adverse flood-related effects. Along the middle and lower Missouri River, a special study plan element is

provided to develop feasible strategies for improved management and regulation of the flood plain within the States of South Dakota, Iowa, Nebraska, Kansas, and Missouri.

In rural areas, Soil Conservation Service watershed programs will reduce damages caused by small floods along watershed project tributaries, and to some degree from infrequent, large floods. In these situations, where appropriate local or State authority exist, integrated Federal, State, and local efforts will discourage non-compatible uses in flood plains which could be inundated by floods. The environmental effects of watershed programs for flood control are similar to those classes of impacts related to the impoundment and channelization of small, intermittent streams, placement of grade stabilization structures, installation of terraces, and use of measures to increase vegetation cover on croplands. Through judicious planning, including consideration of a flood plain avoidance alternative, adverse effects on wildlife and other important natural or cultural beneficial flood plain values can be avoided, minimized, or mitigated. Overall, the cumulative effect of the watershed programs will be to decrease slightly the amount of riparian and stream habitats of small tributaries, but to increase quantities of wetland, pond, and lake habitats. Some added water-related recreation opportunities also will be created.

Fish and Wildlife

Recommended fish and wildlife programs generally will not have cumulative adverse impacts on natural ecosystems, agricultural lands, or other resource systems. Programs of most basinwide significance are those to be implemented along the Missouri River corridor (the Fish Rearing facility program at Lake Oahe and the Missouri River Fish and Wildlife Habitat Mitigation Study) and those which place high priority on protection of special or unique habitats (Endangered Species Program). Other programs, including instream flow studies and habitat evaluation methods, are designed to assess fish and wildlife needs, thus improving decisionmaking in regard to the preservation of natural habitats and to the overall allocation of water and related land resources.

State and Federal cooperative fish and wildlife programs have slight beneficial cumulative effects basinwide. The net long-term effect of all fishery programs will be to improve the fisheries of natural and man-made lakes through stocking, habitat

improvement, and control of adverse environmental factors when possible. The impact on cold and warm water streams is variable, depending on the quality of the stream resource and State management policies. Fisheries in many streams are not easily managed in a cost-effective manner. While wildlife programs will be able to improve habitat for certain species of big game, waterfowl, and some species of upland game, this type of habitat base in many parts of the Basin can be expected to decline because present programs and regulatory efforts cannot develop enough habitat or mitigate adequately against the adverse effects of intensified land and water uses. As a result, riparian, wetland, and native grassland habitats will continue to decline in the near future. The rate of habitat decline, however, will be less than that experienced during the two previous decades.

Irrigation

Irrigation programs are particularly recommended in the semi-arid to sub-humid portions of the Basin in order to improve the productivity and efficiency of agricultural operations in those areas, and to increase overall agricultural productivity of the Basin. Actions are centered around: (1) improving existing irrigation systems, and (2) development of new irrigation systems.

The Rehabilitation and Betterment (R&B) Program provides for the modification of the water diversion and delivery system, for improved return flow management, and for changes in how, when or how much of the water is applied to the land. While overall impacts of the R&B program are considered as beneficial, local impacts are highly variable and must be evaluated in that context. The following general effects, however, can be anticipated: (1) reduction of the amount of water diverted from streams or released from reservoirs during the irrigation season; (2) decrease of water seepage from canals with possible reduction in recharge to underlying aquifers; (3) improvement of agricultural productivity in those instances where water supplies are limited or improved return flow management is needed; (4) increase or decrease of energy use, depending upon how water consumption patterns or delivery systems are changed; (5) loss of some wetlands created by canal seepage; and (6) loss of water supply for water users who are withdrawing from seepage sources. Water quality changes can also be expected. In general, control over sediment and associated pollutants would be increased within a basin where these practices are implemented.

New Federal irrigation development has considerably more potential to increase agricultural productivity, stimulate local economies, and stabilize local population than the Rehabilitation and Betterment Program. With full development of the projects in the regional plan, it is expected that an additional 5 to 6 percent of the Basin's agricultural lands will receive a dependable supply of irrigation water. Implementation of new irrigation developments will induce impacts related to the nature and size of storage reservoirs and water distribution systems, size of surface area, scope of leveling and possible associated drainage operations, type of wildlife habitat or natural values affected, reservoir and streamflow operations, and quantity and quality of return flows. While specific adverse environmental effects have been identified in the individual project environmental impact statements, on a cumulative basis adverse impacts on wildlife population and their habitat, historic and cultural values, water quality, and energy consumption can be expected. Currently these effects are being reduced through planning efforts which deal with modification of project design, or are being mitigated through habitat acquisition or restoration procedures. Effects of added water consumptive use in the Basin by these projects cannot be determined accurately on a cumulative basis because of uncertainties about current water consumption and availability of surface water supplies; however, it is estimated that this would approximate 1 to 2 percent of the annual outflow from the Basin. The Missouri River Basin Commission's Hydrology Study, to be completed in 1982, will address current and future water supply and water usage patterns in considerable detail, enabling future assessments to more accurately display stream flow depletions.

Land Conservation and Management

The recommended land conservation and management programs on a cumulative basis are not expected to produce significant adverse environmental effects and are more often supportive of other programs. Federal and, in some cases, State cooperative wind and water erosion control programs maintain soil resources on agricultural lands and indirectly benefit water quality through control of sediment and associated contaminants. The shelterbelt programs, which encourage the planting of trees and shrubs for windbreaks, indirectly improve the wildlife habitat for many species of terrestrial wildlife. In some instances shelterbelts may improve rural esthetics and provide fuel for heating rural homes. Many State programs in the plan complement Federal programs by providing assistance to landowners in the

application of conservation practices or best management practices such as terrace construction, minimum tillage, contour farming, and crop residue use, to name a few. Federal programs on Indian lands will improve conservation of range, forest, and soil resources, in addition to increasing the productivity of these lands for wildlife and livestock. Streambank protection projects will reduce erosion along the Missouri River and selected tributaries, thereby improving water quality, protecting residences, and preserving agricultural land resources. In certain reaches, riparian woodlands may be protected and fishery habitat improved.

Municipal, Industrial, and Rural Domestic Water Supply

The implementation of recommended water supply programs is not anticipated to produce significant impacts. However, in some localized areas, loss of prime agricultural land or important natural areas could occur if water facilities encourage scattered urban-type developments. Also new water system improvements must be responsive to local environmental conditions to avoid construction and maintenance problems. Federal programs in national parks will improve health aspects of water supply systems. If additional recreation activity is induced, however, adverse effects on fragile natural or cultural resources could occur. Additional adverse effects from remaining water supply programs may be realized where implementation conflicts with other land or water resource uses, including irrigation, fish and wildlife, and instream flows.

Significant beneficial effects will occur to human health and safety through safe drinking water programs that ensure safe and adequate supplies of drinking water and increase economic development potential; however, implementation of these programs also has the potential to conflict with other water users.

Natural, Historic, and Cultural Resources and Water-Associated Outdoor Recreation

Implementation of recommended programs in these functional areas are not expected to have significant environmental impacts and are in harmony with other programs in the plan. Implementation of several park, recreation, wild and scenic river, and historic area management plans may create localized adverse environmental impacts such as site destruction and over use resulting from increased public use. Implementation of the Lewis and Clark National Historic Trail along the Missouri River

will preserve exceptional historic/cultural values as will programs which preserve two nationally important historic sites along the river. Two significant free-flowing reaches of the Missouri will receive added levels of protection through management under the National Wild and Scenic River System. Development and preservation of other park, recreation, and historic sites along Missouri River tributaries will save other notable local and State historic and cultural resources as well as providing increased recreational opportunities and usage. In many instances, these will reduce the severity of two widespread recreational problems: (1) limited river access; and (2) shortage of recreational opportunities in portions of the Middle Missouri and Lower Missouri subbasins.

Local recreational and fish and wildlife benefits will be derived from several other projects and programs, including the Small Watershed Program and purchase of water in a reservoir along the South Fork of the Republican River by Colorado. States also have programs which supplement and assist in implementing recreation goals. These include recreation planning, support services, and development activities.

Power and Energy

Most recommended power and energy programs are feasibility studies designed to examine development opportunities for clean energy supplies (wind and hydropower), and as such do not have direct environmental effects. These studies, however, could lead to the development of new energy supplies which may have specific and possible adverse environmental effects. Several recommended small hydropower projects utilize existing dams to the maximum extent possible and additional impacts are localized and can be minimized. Development of a large pumped storage facility (Boyd County Project) proposed along the Missouri River will have local adverse environmental effects on water depletions, wildlife populations and habitat, and agricultural lands. However, it utilizes offstream storage facilities, thereby avoiding significant damage to the main stem Missouri River ecosystem. Detailed environmental effects are currently being studied.

Transportation

The recommended transportation program is located along the lower and middle Missouri River, and is intended to complete its design and use as a navigable waterway. As the Bank Stabilization and Navigation Project is nearly complete, many of

the adverse environmental effects have already occurred. However, completion and operation of the project in the upper reaches will continue to create difficulties in maintaining existing fish and wildlife habitat due to the tendency of the modified river to destroy adjacent wetlands. Implementation of environmental mitigation phases of the project by agencies identified in the Corps of Engineers' Missouri River Fish and Wildlife Mitigation Study is especially needed because many opportunities have already been lost.

Water Quality

Overall, recommended water quality programs will have beneficial effects on certain aquatic ecosystems through reduction of pollutant loadings and achievement of Federal and State "swimmable and fishable" goals. Most of these near-term benefits will be realized on tributary streams and some natural lakes in the Basin but significant benefits over the long-term also will be felt along the main stem. Federal programs to provide these benefits include assistance in the control of soil erosion through implementation of best management practices in the Rural Clean Water Program and construction of wastewater treatment facilities. Indirect benefits of these programs will be improved fish and wildlife habitat and increased recreation development associated with construction of treatment plant facilities. In some areas, construction of wastewater treatment plants may occasionally produce local adverse environmental impacts, or may induce undesirable urban growth trends.

While individual State efforts to implement water quality management plans may be insignificant basinwide, the collective implementation of State programs with Federal support will improve water quality in the Basin through control of nonpoint pollution sources. Other State efforts will concentrate on licensing, monitoring, and enforcing discharge permittees, and on the identification and implementation of solutions to water quality problems of public lakes. The improvement of water quality realized by these programs will also have indirect beneficial effects on fish and wildlife resources and municipal water supplies.

Legal and Institutional Factors

Several studies have recommended various modifications to the Basin's existing legal and institutional framework for the management of water and related land resources. Implementation

of these recommendations will improve management of fish and wildlife, stream corridors, soils, and surface and ground water supplies. Over the long term, this will help develop and maintain a stable and diversified economy, while accommodating the demands placed on these resources by agricultural, industrial, energy, and recreational sectors.

Instream Flows

Implementation of instream flow study recommendations and programs will have beneficial environmental effects on the rivers and streams of the Basin. Studies will quantify flow levels needed to preserve fish and wildlife habitat, maintain channel capacity, improve water quality and river recreation, and identify ways to meet downstream consumptive uses. In some portions of the Basin, through appropriation or regulation, steps will be taken to reserve streamflows for fish and wildlife and other purposes. Efforts to meet all these needs will have to recognize the conflicts between the various water users.

Weather Modification

Weather modification programs, designed to augment precipitation in the arid to semi-arid portions of the Basin, are subject to a number of uncertainties about the nature and extent of their benefits and impacts. Essentially, they are still being evaluated experimentally, and as such a reliable description of their impacts is not possible.

Adverse Environmental Effects Which Cannot Be Avoided

Consideration of environmental impacts in the planning process conducted at the river basin and project levels has in many instances, eliminated or mitigated many adverse effects. However, several adverse environmental effects, particularly at the local level, cannot be avoided if program purposes are to be accomplished, e.g., supply water to additional lands, develop new sources of energy, control rural and urban flood damages, provide new recreational opportunities, provide new water supplies to municipalities, improve water quality, or control erosion of agricultural lands. These impacts have been broadly discussed in previous sections and more detailed impacts are analyzed in individual project environmental impact statements.

Relationship Between Local Short-term Uses of Man's Environment and the Enhancement of Long-term Productivity

The regional plan has been developed to insure that those resources which contribute to the quality of man's life and environment are managed and safeguarded for succeeding generations. Short-term commitments of resources must be made so that environmental, social, and economic amenities will be available for the present and future generations.

Short-term uses of resources committed to implementation of the plan include those which involve use of fossil fuels, labor, and construction equipment and materials. During construction periods affected areas will experience increased levels of noise, traffic, soil erosion, siltation of streams, disturbance of vegetation and fish and wildlife resources, and influx of construction workers requiring community services.

Long-term agricultural productivity and increased rural population stability will result from programs relating to clean water, soil and water conservation measures, and improved distribution and utilization of water for domestic and irrigation purposes. These will assist in preventing a deterioration of the Basin's soil, land, and water resource base.

Various environmental measures, including those protecting or conserving lakes, streams, wetlands, wilderness areas, and fish and wildlife resources, may decrease some short-term uses and cause management conflicts; in the long run they will result in these resources being preserved for future generations.

The long-term availability of water for supplying irrigation, municipal and domestic needs, increasing hydropower, continuation of maintenance of water in streams and lakes, navigation, and development of fossil fuels is a major concern. Many of the short-term resource-oriented studies are recommended to determine the future management of water resources in order to avoid long-term adverse effects on these uses. The recommended levels of development of additional water supplies for irrigation from the Missouri River does not preclude future development of additional water supplies for energy-related developments, nor does it significantly affect current water uses.

Irreversible and Irretrievable Commitments of Resources Which Would be Involved in the Proposed Action Should it be Implemented

These commitments generally concern changes set in motion by the proposed action which at some future time could not in the practical sense be altered so as to restore the present situation. In the regional plan these commitments include: (1) cultural resources such as capital, labor, energy, and various construction materials and equipment; (2) large amounts of surface water from the Missouri River and several tributary streams for municipal uses and irrigation; (3) lands for water impoundments and irrigation systems; (4) two extensive river reaches and numerous other areas along the Missouri River for natural, historic or recreational purposes; and (5) fragile, esthetic, historic, and other lands preserved or used as wilderness areas, fish and wildlife areas, natural areas, or parks.

FUTURE ENVIRONMENTAL RESPONSIBILITIES

Implementation of the proposed actions is the responsibility of various Federal and State agencies acting in cooperation with local officials. Federal agencies are obligated to comply with the National Environmental Policy Act of 1969, as well as earlier and subsequent environmental legislation and regulations. These include the Endangered Species Act of 1973 as amended, the Clean Water Act, the Fish and Wildlife Coordination Act of 1958, and the National Historic Preservation Act of 1966. Also included are executive initiatives such as Executive Orders 11593 (historic preservation), 11998 (flood plains), and 11990 (wetlands). State and local agencies are obligated to comply with various State environmental statutes and regulations which may include environmental policy acts, flood plain management, water use, major facility siting, zoning, endangered species protection, stream preservation, and prime agricultural land preservation.

Complying with all of the above environmental legislation requires considerable State and Federal manpower devoted to monitoring, coordination, and planning activities as projects are implemented. Therefore, it is particularly important that these agencies receive adequate funding for these missions.

Implementation-related issues which may need further resolution at the project level for the proposed actions include quantification and mitigation of adverse effects on environmental and fish and wildlife values, avoidance of flood plains and wetlands where there are other practicable siting alternatives,

surveys and assessments to determine the nature and importance of archeological and historic resources, quantification of the values of wetland and riparian habitat, detailed analysis of the impacts of various stream alterations, examination of alternatives for the improved conservation of water and energy, identification of impacts on communities affected by power and energy-related projects, and examination of the cumulative effects on the environment created by project implementation.

The future role of the Missouri River Basin Commission in environmental and related matters involves coordinating further studies of environmental issues in the study area through its ongoing planning process. In addition, it will propose funding priorities for programs and projects in the regional plan, assist in keeping State officials abreast of emerging Federal environmental programs and environmental issues which affect the Basin, and review environmental impact statements on plan elements and other major Federal action for consistency with the regional plan and this environmental impact statement. In future planning activities, the Commission expects to provide for the consideration of alternative plans and to increase efforts to quantitatively evaluate cumulative effects of the regional plan. Under the Water Resources Planning Act of 1965, the Commission is not an implementation agency.

LIST OF PREPARERS

The environmental data in this appendix are largely based upon analysis prepared by the Missouri River Basin Commission staff. Materials were reviewed or evaluated by the MRBC Planning Committee prior to publication. Individuals participating were as follows:

MRBC PLANNING COMMITTEE

Capt. James Glasgow,
Department of Transportation
(Chairman)
Terry Lynott,
Department of the Interior
Stewart Jessee,
Department of Agriculture
Gus Karabatsos,
Department of the Army
John Dewey,
Kansas Water Resources Board

MRBC STAFF

Don Becker
Carl Teinert

Robert Dunkeson,
Missouri Dept. of Natural Resources
Clem Lord,
Wyoming State Engineer's Office
Fred Daubert,
Colorado Water Conservation Board

LIST OF AGENCIES AND ORGANIZATIONS

The following list identifies those agencies, organizations, and individuals from whom comments were requested or received with respondents indicated by "*".

States

Honorable Richard D. Lamm, Governor of Colorado
Colorado Water Conservation Board
Department of Local Affairs/Colorado Division of Planning
*Department of Natural Resources/Division of Water Resources
*Colorado State Department of Highways
*Colorado Historical Society
Honorable Robert D. Ray, Governor of Iowa
Iowa Natural Resources Council
Iowa Office for Planning and Programming
*Iowa Conservation Commission
*Honorable John W. Carlin, Governor of Kansas
Kansas Water Resources Board
Kansas Division of State Planning and Research
Honorable Albert H. Quie, Governor of Minnesota
Minnesota Water Planning Board
Minnesota State Planning Agency, Office of Federal Relations
*Honorable Joseph P. Teasdale, Governor of Missouri
Missouri Department of Natural Resources
Missouri Office of Administration
*Missouri Highway and Transportation Commission
Honorable Thomas L. Judge, Governor of Montana
Montana Department of Natural Resources and Conservation
*Department of Agriculture
Montana Office of Budget and Program Planning
*Honorable Charles Thone, Governor of Nebraska
Nebraska Natural Resources Commission
Nebraska Policy Research Office
Honorable Arthur A. Link, Governor of North Dakota
North Dakota State Water Commission
*North Dakota Federal Aid Coordinator Office
*Honorable William J. Janklow, Governor of South Dakota

South Dakota Department of Water and Natural Resources
South Dakota State Planning Bureau
Honorable Ed Herschler, Governor of Wyoming
Wyoming State Engineer's Office
Wyoming Office of State Planning Coordination

Federal Agencies

Department of Agriculture
Department of the Interior
*Department of the Army
*Department of Energy
*Federal Energy Regulatory Commission
*Western Area Power Administration
*Environmental Protection Agency
Federal Emergency Management Agency
Department of Commerce
*Assistant Secretary for Policy
*National Oceanic and Atmospheric Administration
Department of Health and Human Services
*Department of Housing and Urban Development
Department of Transportation

Indian Tribes and Organizations

Blackfeet Tribal Business Council
Crow Tribal Council
Ft. Belknap Community Council
Ft. Peck Tribal Executive Board
Northern Cheyenne Tribal Council
Chippewa Cree Business Council
Arapahoe Business Council
Shoshone Business Council
Iowa Tribe
Sac and Fox Tribe
Kickapoo Tribe
Potawatomi Tribe
Flandreau Santee Sioux Tribe
Devils Lake Sioux Tribal Council
Turtle Mountain Band of Chippewa
Standing Rock Sioux Tribal Council
Omaha Tribal Council
Cheyenne River Sioux Tribal Council
Crow Creek Sioux Tribal Council
Lower Brule Sioux Tribal Council
Oglala Sioux Tribal Council

Rosebud Sioux Tribal Council
Yankton Sioux Tribal Business and Claims Committee
Sisseton-Wahpeton Sioux Tribal Council
Santee Sioux Tribal Council
Winnebago Tribal Council
Three Affiliated Tribes Business Council
Native American Natural Resources Development Federation
American Indian Agricultural Credit Consortium, Inc.

Other Governmental

Big Blue River Compact Administration
International Joint Commission
Yellowstone River Compact Commission

Other Organizations

National Audubon Society, North Midwest Representative
National Audubon Society, West Central Representative
National Audubon Society, Rocky Mountain Representative
National Wildlife Federation, North Central Regional Executive
Nature Conservancy, Midwest Regional Office
Northern Plains Resources Council
Sierra Club, Northern Great Plains Representative
Sierra Club, Northern Plains Regional Conservation Committee
Dakota Resource Council
Missouri River Society

LETTERS REQUIRING NO RESPONSE

FEDERAL ENERGY REGULATORY COMMISSION
CHICAGO REGIONAL OFFICE
230 SOUTH DEARBORN STREET ROOM 3130
CHICAGO ILLINOIS 60604

June 25, 1980

In reply refer to:
OLPR-CH-RB

Mr. Charles P. Metzger
Regional Representative
of the Secretary
Department of Energy - Region VIII
P.O. Box 26247, Belmar Branch
Lakewood, Colorado 80226

Dear Mr. Metzger:

We have reviewed the May 1980 report titled "Missouri River Basin Water Resources Management Plan" and separate Appendices G & H which the Chairman of the Missouri River Basin Commission sent with a copy of his June 2, 1980 letter to the Secretary of Energy. The Draft Environmental Impact Statement, included in the Management Plan as Appendix A, was also reviewed.

Earlier this year, drafts of the report and its appendices were reviewed in relation to FERC's statutory responsibilities. We note that the comments which we offered on the drafts are incorporated in the final version of the report dated May 1980. We have no additional comments.

Sincerely,

Lawrence F. Coffill

Lawrence F. Coffill
Regional Engineer

cc: Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
10050 Regency Circle - Suite 403
Omaha, Nebraska 68114

-270-

JAY B. DILLINGHAM, *Chairman*
Rm 930, Livestock Exchange Bldg.
1600 Genesee
Kansas City 64102

ROY W. JORDAN, *Vice Chairman*
7636 Forsyth Blvd
Clayton 63105

A. C. RILEY, *Member*
301 Davis
New Madrid 63869

ROY H. GOODHART, *Member*
P. O. Box 837
Hannibal 63401

CARL E. YATES, *Member*
1436 South Glenstone
Springfield 65804

EUGENE J. FELDHAUSEN, *Member*
Suite 430
10050 Ambassador Drive
Kansas City 64153

MISSOURI
HIGHWAY AND TRANSPORTATION COMMISSION

ROBERT H. HUNTER, *Chief Engineer*

BRUCE A. RING, *Chief Counsel*

L. V. McLAUGHLIN, *Asst. Chief Engineer*

MRS. IRENE WOLLENBERG, *Secretary*

P. O. Box 270
Jefferson City, Missouri 65102
Telephone (314) 751 2551

RECEIVED

DIVISION OF TRANSPORT
AND PLANNING

June 26, 1980

GENERAL: Application No. 80060096
A-95 Review

Ms. Lois Pohl
Coordinator of Local and Regional Planning
Division of State Planning and Analysis
State Capitol, P. O. Box 809
Jefferson City, Missouri 65101

Dear Ms. Pohl:

The project of the Missouri River Basin Commission for the Missouri River Basin Water Resources Management Plan for the development, conservation, and management of water and related land resources in the river basin is endorsed as a worthwhile project. River basin planning is an integral part of Missouri's comprehensive planning system for the use of our water resources. This project offers no conflicts with other transportation facilities.

Very truly yours,

L. V. McLaughlin

L. V. McLaughlin
Assistant Chief Engineer
A-95 Review Agent

ENVIRONMENTAL IMPACT A[illegible]
Request for Environmental Impact [illegible]

TO: [illegible] Council
[illegible] Clearinghouse
[illegible] Courthouse
[illegible] W. Broadway
[illegible], S.D. 57501

FROM: [illegible]
Office of Budget and [illegible]
Capitol Annex
Helena, Montana 59601

Environmental Impact Assessment Title: Draft EIS
Missouri River Basin Water Resources Management Plan

Clearinghouse File Number: E 80-06 01

EIS Agency Sponsor: Missouri River Basin Commission

SPONSOR ADDRESS: Suite 403, 10050 Regency Circle, Omaha, Nebraska 68114

CONTACT PERSON: Millard W. Hall, Chairman

COMMENTS DUE BY: August 20, 1980

The Above Named Statement

_____ is enclosed for your review and comment
_____ should have been received by your Agency from the [illegible]
__X__ is available at the Clearinghouse Office for review ([illegible] copy was received).

Please evaluate the assessment for its consistency and fullfillment of statewide and local objectives related to:

1. The Environmental impact of the proposed action.
2. Any adverse environmental effects which cannot be avoided should the proposal be implemented.
3. Alternatives to the proposed action.
4. The relationship between local short-term uses of man's environment and maintenance and enhancement of long-term productivity.
5. Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

IF YOUR AGENCY HAS COMMENTS ON THE ENVIRONMENTAL IMPACT ANALYSIS, PLEASE SEND THE COMMENTS DIRECTLY TO THE AGENCY SPONSOR AND FORWARD A COPY OF THE COMMENTS TO THE STATE CLEARINGHOUSE.

IF YOUR AGENCY DOES NOT INTEND TO COMMENT, PLEASE CHECK THE BOX BELOW AND RETURN THIS FORM TO THE STATE CLEARINGHOUSE.

__X__ NO COMMENT

Reviewer's Signature Ethel MacDonald

Title A-95 Coordinator Date 6/30/80

-271-

The State of North Dakota
FEDERAL AID COORDINATOR OFFICE
State Capitol
Bismarck, North Dakota 58505

Wayne G. Sanstead, Lieutenant Governor
FEDERAL AID COORDINATOR

[illegible]

(701) 224-2094

July 7, 1980

"LETTER OF CLEARANCE" IN CONFORMANCE WITH OMB CIRCULAR NO. A-95

To: Missouri River Basin Commission

STATE APPLICATION IDENTIFIER: 8006099553

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403 - 10050 Regency Circle
Omaha, NE 68114

Dear Mr. Millard:

Subject: Draft Environmental Impact Statement for the Missouri River Basin Water Resources Management Plan.

This Draft EIS was received in this office on June 9, 1980.

Thank you for submitting your draft environmental impact statement for review and comment through the North Dakota State Intergovernmental Clearinghouse.

Your draft was referred to the appropriate agencies, and no comments were received to this date.

Please send me copies of the final environmental impact statement and any supplemental impact statements to the North Dakota agencies that have commented on the draft, and to this office. The opportunity to review your draft is appreciated, and if this office as Clearinghouse can be of further assistance with this project, please let me know.

Sincerely yours,

Leonard E. Banks

Mrs. Leonard E. Banks
Coordinator
State Intergovernmental Clearinghouse

BAB/gd

State Intergovernmental Clearinghouse 224-2094 | State & Local Planning 224-2810 | Energy Management & Conservation 224-2250 | Economic Opportunity 224-2667

7 AUG 1980

Mr. Millard W. Hall
Chairman, Missouri River
Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Thank you for your letter of June 2, 1980, to the Secretary of the Army, requesting our comments on the Missouri River Basin Water Resources Management Plan and draft environmental impact statement.

We appreciate the opportunity to review the Management Plan and draft statement and have no comments to offer.

Sincerely,

(signed) Edwin Lee Rogers

Michael Blumenfeld
Assistant Secretary of the Army
(Civil Works)

Rec'd PP/EC AUG 19 1980

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
ENVIRONMENTAL DATA AND INFORMATION SERVICE
Washington, D.C. 20235
Center for Environmental Assessment Services

August 15, 1980 OA:D242:DL

TO: PP/EC - Joyce Wood

FROM: OA/D2x1 - Kenneth Hadeen

SUBJECT: DEIS 8006.22 - Missouri River Basin Water Resources Management Plan

General Comments:
Snowfall and snowpack in the higher elevations of the basin should be mentioned in the section dealing with climate, since these factors are important to the basin's water resources.

Specific Comments:
Page 2-4, paragraph 3: The DEIS states that local climates can be influenced greatly by the Rocky Mountains. The DEIS would be enhanced if it also stated that local climates vary greatly with elevation, slope, and exposure within the Mountains.

Page 2-4, paragraph 4: The DEIS states that "primarily because of its mid-continent location, the basin experiences weather that is known for its fluctuations and extremes". The DEIS would be more correct if it stated that the weather fluctuations and extremes are primarily the result of mid-latitude and mid-continent location.

Page 2-6, paragraph 1: The DEIS defines the frost-free period as "the average number of days each year between the last freezing temperature in the spring and the first frost in the autumn. The DEIS would be enhanced if it stated the freeze-free (not frost) period is the number of days between the last freezing temperature in the spring and the first freezing temperature in the fall.

10TH ANNIVERSARY 1970-1980
National Oceanic and Atmospheric Administration
A young agency with a historic tradition of service to the Nation

CHARLES THONE
GOVERNOR

STATE OF NEBRASKA

LINCOLN 68509
August 29, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

The Nebraska Interagency Water Coordinating Committee has reviewed the Missouri River Basin Water Resources Management Plan, dated May 1980, and the separate Appendices C and H. We feel the plan is a very positive water and related land resources management plan for the Missouri River Basin and will provide a reliable guide for future programming and budgeting. Our Nebraska agencies appreciated participating in the planning effort and feel that collective judgment has helped to produce an excellent product.

There are a few suggestions on behalf of the State of Nebraska that need to be outlined. They are as follows:

1) Table 2-5 on page 2-29 incorrectly describes the general principles of the South Platte River Compact. The Compact actually provides for administration of water appropriators for the two states in a section of the South Platte River between Balsac, Colorado, to include Nebraska's Western Canal. No apportionment of the water supply of the stream or provisions for state-line flows are identified in the 1923 South Platte River Compact.

2) In reference to the third paragraph from the top of page 7-6, the State of Nebraska has not accepted all conclusions outlined in the paragraph as a finding of fact. It should also be further recognized in the fifth paragraph, that flushing the Guernsey Reservoir also serves to evacuate sediment accumulation from the reservoir.

3) The first paragraph on page 7-10 states that the MRBC plan calls for the construction of three major multi-purpose projects. In this listing the Narrows Unit in Colorado is cited. This is inconsistent with the description of the Narrows Unit found on page 7-18 which indicates construction funds have been deferred pending alternative analysis in F.Y. 80. It is the State of Nebraska's sincere desire to review the alternative analysis before providing further comment on storage projects on the South Platte River.

4) We do question conclusion (a) on page 9-21. This conclusion seems to be inconsistent with the most current planning proposal by the Colorado Fish and Game agency.

5) In Appendix H, page H-33, paragraph 4 indicates that the major problems in Salt Creek are organic pollutants and dissolved solids. We point out that inorganic pollutants resulting from a number of industries in the area have also found their way to Salt Creek.

6) In Appendix H, page H-33, paragraph 6, we would amplify the fact that "The North Platte River below Casper, Wyoming carries excessive TDS and TSS concentrations."

7) In Appendix H, the statement on the top of page H-45 under the sub-heading of Natural Area Preservation, implies policies that do not now exist. A more correct statement of the first sentence would be "River reaches in Kansas and Nebraska need studies in order to quantify their values for recreation and other non-consumptive uses."

This concludes our official review of the Missouri River Basin Water Resources Management Plan and we do not have any comments on the Draft Environmental Impact Statement.

Again, the Nebraska agencies appreciated the opportunity to assist in developing the plan and providing comments.

Sincerely,

Charles Thone

CHARLES THONE
Chairman
Interagency Water Coordinating Committee

CT:dwn

STATE OF KANSAS

OFFICE OF THE GOVERNOR
State Capitol
Topeka

August 27, 1980

Dr. M. W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

Reference is made to your letter of May 30, 1980, requesting state views and comments concerning the draft EIS prepared as part of the Missouri Water Resources Management Plan. By separate letter, I have submitted my views on the comprehensive planning document.

The Water Resources Board advises that the EIS was prepared and approved by the Comprehensive Planning Committee of the Commission. In their view, the draft EIS adequately fulfills the requirements of the National Environmental Policy Act. The Board further notes that many of the projects and programs included in the comprehensive plan have separate environmental impact statements that specifically address environmental concerns. It is noted that the general nature of the planning document is such that the impact on the environmental concerns is difficult to assess until the programs and projects included as part of the comprehensive plan are implemented. With reference to the specific concerns expressed by the Environmental Protection Agency regarding the environmental impact statement, the Water Resources Board indicates that they are addressed sufficiently and further revisions to the state are not warranted.

I would concur with the views expressed by the Water Resources Board on the Environmental Impact Statement.

Sincerely,

JOHN CARLIN
Governor

JC:DCS:ko
cc: Francine Neubauer
Executive Director, KWRB

-274-

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Policy
Washington D.C. 20230

September 5, 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle - Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall:

The Missouri River Basin Water Resources Management Plan has been reviewed by this Department and we have no comment pertaining to the Plan.

Sincerely,

Frederick T. Knickerbocker

Frederick T. Knickerbocker
Deputy Assistant Secretary
for Industry Policy

RICHARD D. LAMM
Governor

J. A. DANIELSON
State Engineer

DIVISION OF WATER RESOURCES

Department of Natural Resources
1313 Sherman Street Room 818
Denver, Colorado 80203
Administration (303) 839 3581
Ground Water (303) 839 3587

September 15, 1980

SEP 16 1980

DIV. OF PLANNING

MEMORANDUM

TO: STEPHEN O. ELLIS, COLORADO CLEARINGHOUSE

FROM: HAL D. SIMPSON, CHIEF, WATER MANAGEMENT BRANCH

SUBJECT: MISSOURI RIVER BASIN WATER RESOURCES MANAGEMENT PLAN; JOINT PLAN FOR WATER AND RELATED LAND RESOURCES AND DRAFT ENVIRONMENTAL IMPACT STATEMENT

We appreciate the opportunity to review and comment on the above Plan and Draft Environmental Impact Statement with respect to its impact on water resources of the basin. Our office commends the Missouri River Basin Commission on a very comprehensive report establishing a management plan which would insure a better understanding of the water and related land resources within the basin. We do not have any objections to the plan and draft statement provided future development under the plan does not conflict with Colorado state water statutes.

Hal D. Simpson, P.E.

HDS/JMS:mvl

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STATE OF MINNESOTA
WATER PLANNING BOARD

OFFICE OF THE CHAIRMAN
600 AMERICAN CENTER BUILDING
150 EAST KELLOGG BOULEVARD
SAINT PAUL, MINNESOTA 55101
612) 296-1424

October 2, 1980

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Chairman Hall:

Thank you for the opportunity to review the Missouri River Basin Water Resources Management Plan and E.I.S. A planning effort of this magnitude is a most difficult task, and you and your staff have done a commendable job.

The state of Minnesota has only one substantive comment to offer concerning the reports. We request that our Cooperative Soil Survey Program be added to the listing of Recommended Comprehensive Planning and Support Activities located on page 2-49 of the April, 1980 draft plan. The lead agencies for the program are the SCS and our Agricultural Experiment Station, and the program's combined statewide P.Y. 80 funding totals $1,807,000. A PIR is enclosed.

Thank you for your continuing assistance and cooperation.

Sincerely,

Thomas Kalitowski

THOMAS KALITOWSKI
Chairman

TK:ps
Enclosure

AN EQUAL OPPORTUNITY EMPLOYER

LETTERS REQUIRING RESPONSE

THOMAS L. JUDGE
GOVERNOR

STATE OF MONTANA
DEPARTMENT OF AGRICULTURE

AGRICULTURE / LIVESTOCK BUILDING [redacted] CAPITOL STATION

HELENA, MONTANA 59601

TELEPHONE:
AREA CODE 406
449 3144

W. GORDON McOMBER
DIRECTOR

July 18, 1980

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha NE 68114

Dear Mr. Hall:

The Montana Department of Agriculture is basically in support of the Missouri River Basin Commission's plan for water and related land resources management that was outlined in your report, "Missouri River Basin Water Resources Management Plan and Draft Environmental Impact Statement". We have reviewed the report and would like to offer the following comments:

(1) Two areas of concern to water management are efficient utilization of irrigation water and the quality of irrigation return flows. These concerns were addressed in your report; however, we feel there is a need for the MRBC to consider and recommend these potential programs:

1. Needed are programs and funding aimed at developing methods for more efficient irrigation water use. These studies, while maintaining or furthering production on irrigated lands, would help alleviate the problems of sediment pollution, soil erosion, eutrophication, and water warming caused by some irrigation return flows.

2. We encourage the continuation of water quality monitoring by the U.S.G.S. However, in view of current concerns, monitoring should include, at relevant locations in the Basin, chemical analyses for currently used pesticide residues in water including 2,4-D, Endrin, Tordon, and others. This program would assist the Montana Department of Agriculture and other agencies in identifying problem areas of pesticide runoff or misapplication, would encourage the discriminate use of pesticides, and would help protect aquatic and riparian habitats.

Comments on plan, not Draft Environmental Impact Statement

An Affirmative Action/Equal Employment Opportunity Employer

(2) We advocate inclusion in the final EIS of a review of all programs that were considered by the MRBC, including those not recommended, and a discussion of their related impacts. In the Draft EIS, it was not apparent to us what programs had been reviewed and not recommended, if any, and reasons for those decisions. 1

For further information, please contact the Environmental Management Division, Montana Department of Agriculture, phone: 449-2944. Your consideration of these comments is appreciated.

Sincerely,

W. Gordon McOmber
Director

MRBC RESPONSES

1 The procedure used to develop the regional plan did not provide for the identification and consideration of a series of alternatives. Rather, the Commission relied upon the subbasin planning teams and environmental assessment at the local level to evaluate potential plan elements with respect to their effectiveness in addressing identified problems and opportunities. Currently, the Commission is reviewing its planning process which includes an evaluation of how to better develop and evaluate the effects of alternative plans during further update of the regional plan.

IOWA
CONSERVATION COMMISSION
Wallace State Office Building Des Moines, Iowa 50319
515/281 5145
An EQUAL OPPORTUNITY Agency

July 22, 1980

Mr A Thomas Wallace, Jr
Federal Funds Coordinator
Iowa Office for Planning
and Programming
523 East 12th Street
Des Moines, Iowa 50319

RE: Project No 801747, Missouri River Basin Water Resources Management Plan

Dear Mr Wallace:

Staff within the Iowa Conservation Commission has reviewed the subject report and wish to register several comments We feel these are substantive comments, and that proper modifications are needed to make the Missouri River Basin Water Resources Management Plan acceptable.

General Comments

Recreation is virtually ignored throughout the report except for an occasional mention of improved facilities below Corps impoundments The State's efforts in this regard, including significant water resource projects such as Snyder-Winnebago are not mentioned The use of cooling water for lake restoration is mentioned but only as a future possibility. A functional project such as Brown's Lake should be mentioned.

The use of water from within the basin to irrigate lands outside the basin is promoted throughout the report when this is not necessarily the position of all agencies in the state. The opposing views or potential adverse effects should be discussed

The report seems to infer that management of the water and related land resources is best left to a large, probably federal, agency Iowa's position has been quite to the contrary, i e state involvement in management decisions should be increased

Stream sedimentation and aggradation are referenced throughout the report as problems The associated problem of degradation does not receive like emphasis. From Iowa's perspective, the degradation issue is a major one It is a phenomena based almost entirely on previous river modifications, and one which has had and will apparently continue to have substantial adverse impacts on recreation and fish and wildlife

Specific Comments

P 2-7, paragraph 3: "upland game birds tend to be scarce" Iowa game bird populations are not scarce, we have sizable numbers of both pheasant and quail

P 2-32, last paragraph -In addition to problems with water rights on Indian and federal lands, in Iowa problems consist of the lowering of the water table due to degradation with the losses of wetland and accretion of state land into private ownership

P 2-37 The portion of Chapter 2 titled "Recommended Programs--Basinwide" ignores recreation The subhead is listed but left completely blank

P 2-47 -In the "Recommended Programs--Statewide" portions, the full range of views and concerns of this state are not mentioned There is no mention anywhere in the report of loss of sovereign land through proposed actions (water withdrawals or degradation

P 2-56 Iowa- The state of Iowa has fish and wildlife interests on the Missouri River The following programs have been initiated in Iowa

Iowa Conservation Commission	Public Land Management
	Fish Management Program
	Fish and Wildlife Mitigation

P 5-8 Hydro power and irrigation are stressed as prime objectives or important concerns but no mention is made of possible impacts on other sub basins Even though this is supposed to be a coordinated report, the sub basins are still given highly individualized attention We realize that due to the varying conditions in each sub basin, this is necessary to some extent

P 8-6 Unclear, but the blame for oxbow lake elimination is inferred as being upstream consumptive use When the discharge from Gavin's Point is the highest on record and the oxbows are continually lowering, how can upstream consumption be blamed Channel degradation must be a significant causative factor that should be addressed.

P 8-278 Diversion of water to other areas of the nation would not be looked at favorably by all agencies within the state of Iowa

P A-48 Missouri's program "Design for Conservation" cannot be duplicated in other states upstream Geographic features of the channel caused by degradation is not conducive to wetland development Mitigation of fish and wildlife habitat losses and future losses should be implemented by the Corps

P A-16 Transportation In the statement "recommended transportation programs will improve design and use of the river as a navigable waterway", what are these improvements in design and can we anticipate increased use? If so, what are the impacts on fish and wildlife, recreation and land use, should these issues be addressed? 1

1 The recommended transportation program is the Missouri River Navigation and Bank Stabilization Control Program. Additional information about the impacts of this project is provided in the "Transportation" section of the environmental impact statement.

P. A-17--Transportation. The Bank Stabilization and Navigation Project is nearly complete, but the adverse effects of this will continue to accrue for years. 1

As expressed by the previous comments in the review of this document, we would request notification of any conference to be held in regard to these matters. Thank you for the opportunity to comment on this project.

Sincerely,

ROBERT G. FAGERLAND
ACTING DIRECTOR
IOWA CONSERVATION COMMISSION

RGF:rt

U.S. Department of Housing and Urban Development
Office of Regional Administrator

In Reply Refer to:

Regional Office
Professional Building
1103 Grand
Kansas City, Missouri 64106

August 19, 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle - Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall:

I-283-

This is in reply to your letter to Secretary Landrieu requesting Departmental review by August 20, 1980, of the Draft Environmental Impact Statement (EIS) appended to the Missouri River Basin Water Resources Management Plan. This letter transmits the official Department of Housing and Urban Development comments on the subject EIS.

The water resources management plan generally presents a comprehensive guide for the development, conservation, preservation, and management of water and related land resources in the Missouri River Basin. The appended draft EIS focuses on the qualitative effects of implementation of programs identified in the plan and reflects an analysis generally commensurate with the level of planning contained in the management plan. In this respect the draft EIS is found to be satisfactory in meeting the spirit and intent of the National Environmental Policy Act (NEPA) of 1969.

However, in reviewing possible power and energy programs in the Upper Missouri and Yellowstone subbasins, and in relating those programs to the Department's continuing interest in the well being of communities impacted by power and energy development programs, a concern must be registered. The concern is that there is only minimal identification of negative effects on communities impacted by power or energy-related projects or programs.

The Department is closely monitoring growth in the Upper Missouri and Yellowstone subbasins and the increasing demands placed by energy development on housing and community development resources. Further identification in the EIS of power and energy associated impacts, trade-offs and mitigating measures to minimize adverse impacts related to implementation of proposed power and energy development programs may be appropriate. The appropriateness is

1 1

It is correct to state that the regional plan includes the recommendations of previously completed level B studies, including the Yellowstone River Basin and Adjacent Coal Area Level B Study. The planning process utilized in the regional plan update, however, did not provide for the examination of those recommendations in the Yellowstone Study which are policy oriented. One such recommendation is the continued or expanded development of coal and other energy resources. Since this is an important factor in the future growth of the region, the environmental impact statement recommends that the impacts of energy development projects on housing and community resources be determined prior to energy project implementation activities. This need is further explained in a new section of the environmental impact statement entitled "Future Environmental Responsibilities."

reinforced by the fact that the subject EIS covers the full water resources management plan, which includes the Yellowstone River Basin and Adjacent Coal Area Level B Study.

If not included in the final EIS, consideration of these impacts should be included in future specific project studies or assessments preceding power or energy-related project implementation activities or action. 1

Thank you for providing the Department the opportunity to comment on the draft Environmental Impact Statement.

Sincerely,

William O. Anderson
Regional Administrator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
324 EAST ELEVENTH STREET
KANSAS CITY MISSOURI 64106

AUG 28 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle, Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall:

Missouri River Basin Water Resources Management Plan

The Region VII (Kansas City) and Region VIII (Denver) offices of the U.S. Environmental Protection Agency have reviewed the Draft Environmental Impact Statement for the management plan identified above. The following comments reflect the concerns of both Regional Offices and should be considered in that context. Combined comments on the management plan will be submitted to your office under separate cover by September 3, 1980, as requested in your transmittal letter.

We have rated the draft statement ER-2. This rating means our Agency has reservations with the environmental effects of the management plan and requests additional information be provided in the final impact statement. Our concerns focus on two areas. First, a more detailed discussion is needed of the impacts typical to each of the 14 water resource functions used for grouping plan recommendations. Second, there should be a discussion of the cumulative environmental impacts of all recommended projects on the Missouri River Basin. Both of these issues must be addressed in greater detail in the final impact statement. 1 2

We recognize and appreciate the leadership role the Commission members and staff have assumed in assessing environmental effects associated with Level A and Level B planning documents. This effort to integrate environmental concerns into the planning process can only improve water resource management of the Missouri River Basin. To support these efforts, our staff is available to assist your office in preparing the final impact statement.

Thank you for the opportunity to comment on this draft statement. If you have questions regarding our comments, please contact me. The members of my staff most familiar with the project are Jack Bale and Robert Fenemore. They can be reached at (816) 374-6391 or (816) 374-2921, respectively.

Sincerely yours,

Kathleen Q. Camin, Ph.D.
Regional Administrator

cc: Region VIII Regional Administrator

MRBC RESPONSES

1 Acknowledged. The "Impacts of Proposed Actions" section has been revised to describe the typical impacts of the plan elements grouped according to each water resource function.

2 Identification of quantitative cumulative effects of all recommended programs cannot be made because of limited program information and inadequate or conflicting water and related land resources data bases. A qualitative description of cumulative effects, however, has been described in several functional program areas where information was available.

STATE OF SOUTH DAKOTA

EXECUTIVE OFFICE

WILLIAM J. JANKLOW
GOVERNOR

September 8, 1980

Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Thank you for the opportunity to review and comment upon the Missouri River Basin Water Resources Management Plan. The document is a comprehensive review of current planning activities throughout the basin and it will be extremely useful in our ongoing water planning process. Some comments, however, must be made regarding programs which will affect South Dakota.

The Garrison Diversion Unit is one of the recommended programs in the Eastern Dakotas Basin. Because of uncertainties as to the final design of the project, the impacts of the project on South Dakota are not known. I am on record supporting the project providing that assurances are made protecting South Dakota's interests in the areas of water rights, flooding and water quality. We are currently studying the effects of the project and will continue to cooperate with the State of North Dakota and the Water and Power Resources Service in an effort to develop a project which will be acceptable to and benefit both states. At this time, however, I feel it important to make South Dakota's reservations to the currently authorized project known.

The Department of Water and Natural Resources is currently engaged in a study jointly with the U.S. and South Dakota Geological Surveys, the U.S. Environmental Protection Agency, and the East Dakota Conservancy Subdistrict. The study is a water quality analysis of the Big Sioux Aquifer in Eastern South Dakota. While it was begun too late for original inclusion into the report, the study is an important one and should be included in the Management Plan.

STATE CAPITOL BUILDING PIERRE SOUTH DAKOTA 57501 • (605) 773 3212

The Draft Environmental Impact Statement appears to be a reasonably accurate assessment of the environmental effects of the recommended programs. Nevertheless, while I realize that an in-depth analysis of the effects would require several volumes, the treatment given is somewhat cursory. | 1

Thank you once again for the opportunity to review the plan.

Sincerely yours,

William S. Janklow

WJJ:NMH85510

1 The general level of the environmental impact statement reflects the level of planning carried on during the study. The "Impacts of Proposed Actions" section has been revised to provide typical impacts of the plan elements. Project specific environmental impact statements should be consulted for an in-depth analysis of environmental impacts. In addition, each agency with implementation or review authority has responsibility to insure that this information is developed for project or programs within their geographic range of concern.

EXECUTIVE OFFICE
STATE OF MISSOURI
JEFFERSON CITY

JOSEPH P. TEASDALE
GOVERNOR

September 10, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

This is in answer to your request for a review of the Missouri River Basin Commission's Water Resources Management Plan, Draft Environmental Impact Statement, May, 1980.

It is recognized that this Draft Environmental Impact Statement is your first attempt to follow the revised guidelines of the National Environmental Policy Act. The intent is to report a level of analysis of environmental impacts which corresponds to the level of detail describing the proposed action.

However, the results are statements which are, sometimes, too generalized or, in other cases, not true for our particular state situation. 1

This means I could not endorse the Environmental Impact Statement as "adequate". Instead, I suggest that your future efforts incorporate National Environmental Policy Act procedures into the planning process. My reviewers need to be able to recognize the plan alternatives which were considered, and how the recommended plan was selected among the alternatives. 2

Thank you for requesting my review of this document.

Sincerely,

Joseph P. Teasdale
GOVERNOR

1 The level of analysis conducted during development of the environmental impact statement reflects the level of planning carried on during the study. In addition, effects of recommended programs must remain broad or general until implementation work can identify a recommended alternative for action. However, an attempt has been made to revise the "Impacts of Proposed Actions" section to describe a wider range of typical impacts of the plan elements. Project specific environmental impact statements or planning reports, if available, should be consulted for impacts of specific recommended alternatives.

2 The procedures used to develop the regional plan did not provide for the identification and consideration of a series of alternatives. Rather, the Commission relied upon the subbasin planning teams and environmental assessment at the local level to evaluate potential plan elements with respect to the effectiveness in addressing identified problems and opportunities. Currently, the Commission is reviewing its planning process which includes an evaluation of how to better develop and evaluate the effects of alternative plans during the preparation of the regional plan.

COLORADO STATE DEPARTMENT OF HIGHWAYS

September 10, 1980

SEP 11 1980

DIV. OF PLANNING

Mr Phillip H Schmuck
Director
Colorado Division of Planning
520 State Centennial Building
1313 Sherman Street
Denver, Colorado 80203

Dear Mr Schmuck

The Colorado Department of Highways has completed its review of the Draft Environmental Impact Statement for the Missouri River Basin Water Resources Management Plan and has the following comments

We would appreciate being given the opportunity to review the environmental impact statements prepared for those specific projects in Colorado that would impact the state highway system. | 1

Thank you for the opportunity to review this document

Very truly yours,

Harvey R Atchison
Director
Division of Transportation Planning

By
Barbara I S Chocol
Manager
Impact Evaluation Branch

RG

1 | For all projects requiring an environmental impact statement, the Colorado State Department of Highways should have the opportunity to review impacts to the State highway system through its continuing participation in the A-95 process. This process should also provide the same opportunity for review of ongoing or new water resources projects.

4201 EAST ARKANSAS AVENUE DENVER CO 80222 (303) 757 9525

COLORADO
HISTORICAL
SOCIETY

The Colorado Heritage Center 1300 Broadway Denver, Colorado 80203

September 11, 1980

Mr. Stephen O. Ellis
Principal Planner
A-95 Clearinghouse
420 State Centennial Building
1313 Sherman Street
Denver, Colorado 80203

SEP 11 1980

DIV. OF PLANNING

Dear Mr. Ellis,

This office has received and reviewed the the Missouri River Basin Water Resources Management Plan, #80-146.

The regulations of the National Environmental Policy Act request that all documents prepared under the provisions of that Act include compliance with Federal preservation laws. These separate, obligatory laws, the National Historic Preservation Act of 1966 as amended, and Executive Order 11593, require the consideration of cultural properties beginning with the planning stages, continuing throughout the execution of any Federally supported, funded, or licensed undertaking. The procedures to implement this law and supporting Executive Order are set forth in Federal Regulation 36 CFR 800. 1

These regulations require the following procedures:

(1) To Identify by qualified personnel cultural resources that are Eligible to the National Register of Historic Places within the impact area. This investigation also includes consulting the National Register of Historic Places, the Colorado Inventory of Historic Sites and the State Archaeology Files to identify known resources (2) To Determine the Effect of the proposed project on resources determined to be Eligible (3) To develop plans to Avoid or Mitigate the Adverse Effect on Eligible resources.

We look forward to working with the agency to insure adequate consideration of cultural properties.

Sincerely,

Arthur C. Townsend
State Historic Preservation Officer

ACT(BJL):ng

#516 Compliance

1 Under the Commission's current planning process, it has been assumed that compliance with the National Historic Preservation Act of 1966 and Executive Order 11593 is the responsibility of agencies reviewing or implementing elements of the plan. While this obligation will continue in the future, the Water Resources Council is establishing rules which will provide River Basin Commissions with procedures for consulting with State historic preservation officers and others associated with historic preservation activities during initial stages of planning.

Department Of Energy
Western Area Power Administration
P.O. Box 3402
Golden, Colorado 80401

SEP 15 1980

IN REPLY
REFER TO: A6000

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle, Suite 403
Omaha, NE 68114

Dear Mr. Hall:

Thank you for providing a copy of the May 1980 Missouri River Basin Water Resources Management Plan and draft Environmental Impact Statement (EIS) to Secretary Duncan. We have reviewed the management plan, EIS, appendix G (State Planning Objectives) and appendix H (Water Resources Problems and Opportunities). We have no comments on the management plan and the appendices. We do, however, have some concern about the draft EIS.

We recognize the Commission's responsibility and position regarding development of the Missouri River Basin resources. However, we would like to reiterate that although the draft EIS may be adequate for management plan purposes, it is not adequate for specific projects that are stated in the plan. We assume that the federal and State agencies who have the direct responsibility of developing such projects will provide specific EIS's in more detail for their respective projects, including cumulative impacts. 1

We suggest that the above considerations regarding EIS coverage be included in the preface of the management plan so that there is no confusion as to the extent and applicability of the EIS information contained in the body of the plan. If you have any questions about our comments, please let us know.

Sincerely yours,

Robert L. McPhail
Administrator

1 Federal agencies which have responsibility for implementing plan programs will provide specific environmental assessments for major Federal actions. This responsibility has been clarified in the plan report and the "Purpose of and Need for Action" section of the environmental impact statement. In addition, these responsibilities and those of the Commission and States are further explained in a new section titled "Future Environmental Responsibilities."

Department of Energy
Washington, D.C. 20585

SEP 19 1980

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
10050 Regency Circle, Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall:

We are pleased to have the opportunity to review both the "Missouri River Basin Water Resources Management Plan" and its draft environmental impact statement. The plan, with its findings and recommendations, is interesting and will prove useful for future work.

Our strongest criticism of these materials lies with their sparse treatment of the use and potential use of water by energy. Present discussion is limited primarily to hydroelectric power--including pumped storage, wind power, and coal slurry pipelines; this does not adequately reflect energy concerns of the region. For instance, there is only a two-sentence reference to the expected growth of industrial water use for energy in the Upper Missouri Subbasin--page 3-5. For the Yellowstone Basin, discussion is limited to two or three sentences on page 4-7.

More detailed comments are enumerated in the enclosure.

Sincerely,

Ruth C. Clusen

Ruth C. Clusen
Assistant Secretary for Environment

Enclosure

Enclosure

REVIEW COMMENTS
"MISSOURI RIVER BASIN WATER RESOURCES MANAGEMENT PLAN"

- Chapter 2 of the plan and the draft environmental impact statement do not include discussion of energy development other than hydroelectric power and wind power. However, future energy extraction and conversion will impact water quantity and quality, land use, and the ecology. Department of Energy projections of energy use are available; for example, our Regional Issue Identification Assessment (first annual report, September 1979) used Trendlong C Scenarios. | 1

- The plan should include discussion of potential development of at least the Fort Union and Powder River coal regions. This would include what alternative modes, locations, and levels of development would mean and what your future plans might have to examine. For example, when considering the mining and shipping of coal versus mine-mouth conversion, what do these alternatives mean in regard to water needs, waste disposal, and potential solutions?

- The legal-institutional section of the plan should include a discussion of the competition for water, especially between agriculture and energy.

- Discussions of water resource problems and opportunities should include impacts on ground water quality due to mining of energy resources, and also include discussion of nonpoint pollution from surface mining.

- The plan should discuss alternatives for water resource management to meet future energy needs, and indicate how on-going or future studies address and integrate these alternatives. For example:

  -- What are the efficiencies of water management that relies on private, nominally "single-purpose" reservoirs designed to meet energy needs versus public "multipurpose" reservoirs? Can both be timely? Is one approach necessarily more acceptable environmentally?

  -- What would be the acceptability of intersubbasin transfers to meet coal development needs?

  -- What is the potential for modifying the operational modes of the various types of reservoirs to provide water for potential coal development?

- The draft environmental impact statement should discuss the above alternatives from a generic environmental standpoint. | 1

MRBC RESPONSES

1 | The environmental impact statement addressed issues of programs recommended in the plan. Future revisions of the plan will consider other energy issues and sources besides hydroelectric and wind power, and subsequent environmental impact statements will be expanded to consider additional and broader environmental effects.

2

Future work to resolve water rights associated with Indian and Federal lands is recommended, page 2-66. The plan should indicate the implications of the adjudication of this and side issues. That is, can "planning" really proceed without more clear definition of such overhanging issues?

APPENDIX A – INDEX OF RECOMMENDED PROGRAMS BY LEAD AGENCY

APPENDIX A

INDEX OF RECOMMENDED PROGRAMS BY LEAD AGENCY

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APPENDIX C – STATE PLANNING OBJECTIVES

APPENDIX C

STATE PLANNING OBJECTIVES

During the process of updating the Missouri River Basin water resources management plan, planning objectives were prepared for each basin State in the Missouri River Basin. State members of the Commission examined their respective State laws and policies and formulated a set of planning objectives which were organized into functional categories. These objectives were then reviewed and assembled by subbasin for the planning teams and were used in evaluating Federal, State, regional, local, and private water and related land resources management and development programs for consistency with identified objectives.

The planning objectives of the ten Missouri River Basin States are described in this appendix. Each States' objectives are arranged alphabetically under fourteen functional areas. If a State's objective in a functional area is not stated, that State's objective was not determined during this process. The functional areas are as follows:

Comprehensive Planning and Support Activities
Flooding
Fish and Wildlife
Irrigation
Land Conservation and Management
Municipal, Industrial, and Rural Domestic Water Supply
Natural, Historic, and Cultural Resources
Power and Energy
Water-Associated Outdoor Recreation
Transportation
Water Quality
Legal and Institutional Factors
Instream Flows
Weather Modification

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

COLORADO

Colorado has completed two phases of its State water plan, a resource inventory and legal framework, both done in cooperation with the Water and Power Resources Service. A near-term objective is development of phase III, the water resources management plan. Comprehensive planning for management of the State's ground and surface water resources is intended to support the future economic and population growth of the front-range area and to evolve means to equitably solve water-use conflicts through policy guidance and legislation.

Colorado State government must encourage the expanded utilization by local governments of all available planning tools and, where necessary, provide additional mechanisms to ensure the conservation of fragile, scenic, and open-space areas.

IOWA

Iowa State policies list several objectives regarding comprehensive planning. State laws require State agencies to fund and implement a protected water area system, establish through a rule-making procedure, use priorities and allocation criteria on aquifers, and employ river basin planning as a water quality management mechanism.

In responding to these objectives, agencies of the State must prepare resource inventories, a general plan that outlines statewide goals and objectives, and an in-depth plan for recommended areas of the State. The latter plan should include specific land-use regulations, acquisition recommendations, and management and funding needs.

KANSAS

The Kansas Water Resources Board (KWRB) is responsible for developing the State water plan in cooperation with other State agencies. The plan presents long-range and short-range goals for water management and calls for a water resources inventory and a recurring five-year water needs inventory. The plan is effective only after legislative enactment. The State statutes list by name major reservoirs and watershed projects included in the plan. The KWRB is currently updating the short-range goals of the water plan.

MINNESOTA

The Minnesota Water Planning Board shall:

a. direct the preparation of the framework water and related land resources plan;

b. assure the participation of the public and all units of government in the preparation and implementation of all State water resource planning activities;

c. direct all State involvement in activities undertaken pursuant to the Federal Water Resources Planning Act, Public Law 89-80;

d. evaluate State participation in the Federal-State river basin commissions and make recommendations to the governor and legislature concerning continuing State involvement;

e. evaluate and recommend improvements in State laws, rules and procedures in order to reduce overlap, duplication, or conflicting jurisdictions among the many State and interstate agencies having jurisdiction in the area of public water resource management and regulation; and

f. coordinate public water resource management and regulation activities among the State agencies having jurisdiction in the area.

This plan will relate each of the programs of the Department of Natural Resources for specific aspects of water management to other State and Federal agency programs. The statewide plan will include provisions for the following:

a. regulation of improvements and land development by landowners abutting the beds, banks, and shores of lakes, streams, watercourses, and marshes;

b. regulation of encroachments in the flood plains of rivers, streams, lakes, and marshes;

c. modifications of previously established public drainage systems;

d. preservation of wetland areas;

e. management of game and fish resources as related to water resources;

f. control or alleviation of damages by flood waters;

g. alteration of stream channels for conveyance of surface waters, navigation, and any other public purposes;

h. diversion or changing of water courses in whole or in part;

i. regulation of the flow of streams and conservation of these waters;

j. regulation of lake water levels;

k. maintenance of water supply for municipal, domestic, industrial, recreational, agricultural, esthetic, wildlife, fishery, or other public use;

l. sanitation and public health and regulation of uses of streams, ditches, or water courses for the purpose of disposing of waste and maintaining water quality;

m. prevention or remedial measures to control or alleviate land and soil erosion and siltation of affected water courses or bodies of water; and

n. regulation of uses of water surfaces.

Separate legislation requires the Department of Natural Resources to prepare a statewide framework and assessment water and related land resources plan.

MISSOURI

Missouri's Department of Natural Resources indicates the State's objectives are to promote the wise use of water resources by identifying and responding to critical concerns and to determine the availability and character of Missouri's water resources in order to provide the information needed for their optimum development and management. River basin planning is an

integral part of Missouri's comprehensive planning system which includes the development of a comprehensive long-range State plan for the conservation, development, management, and use of water resources.

MONTANA

Montana's goal is to have a comprehensive plan prepared for the entire State by 1980. In order to complete its river basin studies, it is imperative that Montana continue to receive Title III funding. Studies involving water availability and studies leading to coordination of water quality and quantity planning and management are particularly crucial.

NEBRASKA

To promote the most efficient and beneficial development, management, and utilization of the State's land, water, mineral, oil, timber, and other natural resources.

NORTH DAKOTA

North Dakota's Interim State Water Resources Development Plan, which was published in 1968, is now being updated. It is the goal of the North Dakota Water Commission to have the Missouri River Basin Commission CCJP regional planning process integrated into North Dakota's water planning process where possible. Regional river basin planning is an essential facet of the State's comprehensive planning system. The overall objective of the State water planning process is to provide guidance for efficient utilization of available water resources for the economic growth of the State while maintaining overall environmental integrity.

SOUTH DAKOTA

The South Dakota water planning process is designed to provide a dynamic information base, an identification of water related issues and recommendations for managing the development and conservation of water and related land resources of the State. The three major areas involved in the planning process are:

a. Computerized Natural Resources Inventories; the first step in the statewide water resources planning process is to develop a comprehensive computerized inventory of

South Dakota's resources. This computer system would be a dynamic inventory which would eventually provide a comprehensive data base of South Dakota's natural resources.

b. Statewide Water Plan; the statewide water plan is an aggregation of all existing water resources projects and water resources projects that are proposed for the future in the State of South Dakota. Its purpose is to coordinate management of the State's water and related land resources.

c. State Water Resources Management System; the State water resources management system consists of those parts of the statewide water plan established by the legislature as a needed objective for water resources management in South Dakota and for which the legislature may authorize construction and financing in whole or in part. The system's purpose is to provide the means for the planning, funding and construction of a State water resources management system for the State of South Dakota.

WYOMING

The basic State water plan shall be as developed by the Wyoming Water Development Commission with detailed feasibility studies conducted on specific items of the plan. Content of the plan will include inventory of the State's water and related lands, identifying current uses and projections for possible future uses. While the main objective of the plan is to address intrastate situations, it shall be correlated with regional and river basin plans to the extent practical. Prime consideration is to be given to identification of multipurpose projects to enable the most efficient and beneficial utilization of the resources.

FLOODING

COLORADO

Colorado law is designed to restrict the use of designated flood plains, to prohibit placement of materials and structures which obstruct flood flows, and to protect the public from avoidable expenditures for flood-control projects and flood-relief measures. The State recognizes the need for an

intergrated flood prevention program through structural measures as well as nonstructural management of the flood plains and watersheds.

IOWA

The Iowa Code in section 455A.2 declares that: It is hereby recognized that the protection of life and property from floods, the prevention of damage to lands therefrom, and the orderly development, wise use, protection, and conservation of the water resources of the State by the considered and proper use thereof, is of paramount importance to the welfare and prosperity of the people of the State, and, to realize these objectives, it is hereby declared to be the policy of the State to correlate and vest the powers of the State in a single agency, the Iowa Natural Resources Council, with the duty and authority to establish and enforce an appropriate comprehensive statewide program for the control, utilization, and protection of the surface and ground-water resources of the State.

KANSAS

The State's long-range goals call for reduction of damaging floods and losses resulting from floods. Also, State policy declares that the State will assist public corporations in developing flood control projects that benefit the general welfare. General objectives in achieving the above goals include:

a. the design of proposed levees and dikes so as to reduce flood risks in agricultural areas to a chance of occurrence in any one year of 10 percent or less;

b. the design of proposed levees and dikes so as to reduce flood risks; in urban areas to a chance of occurrence in any one year of one percent or less;

c. the design of proposed storage structures for the protection of agricultural areas so as to provide sufficient capacity to control the volume of a flood having a chance of occurrence in any one year of four percent or less;

d. the design of proposed storage structures for the protection of urban areas to provide sufficient capacity to control the volume of a flood having a

chance of occurrence in any one year of two percent or less; and

e. the use of structural, nonstructural, or a combination of measures for flood damage abatement as determined on a case-by-case basis.

MINNESOTA

It is the policy of Minnesota to reduce flood damages through flood plain management, stressing nonstructural measures such as flood plain zoning, flood proofing, and flood warning practices. It is the policy of the State not to prohibit but to guide development of the flood plains, to provide coordination and assistance to local governmental units in flood plain management, to encourage local governmental units to adopt, enforce, and administer sound flood plain management ordinances, and to provide the commissioner of natural resources with authority necessary to carry out a flood plain management program for the State and to coordinate Federal, State, and local flood plain management activities.

In furtherance of this policy, flood plain management ordinances are to be given primary consideration in the reduction of flood damage in Minnesota and alternative methods for reducing flood damage may not be carried out before adoption of flood plain management ordinances by local governmental units. Structural projects which have the purpose of controlling floods are to be considered only as elements of a flood plain management program.

MISSOURI

To promote the best possible use of flood-prone lands in Missouri:

a. develop agreements to coordinate flood plain activities between adjoining States as much as possible;

b. promote nonstructural alternatives to flood control where possible; but to use structural, nonstructural, or a combination of measures for flood damage abatement as determined on a case-by-case basis;

c. avoid direct or indirect support of hazardous or nuisance flood plain use.

MONTANA

In Montana, there are two separate and distinct programs for flood plain management. One program mandated by State Legislation enacted in 1971 (Floodway Management and Regulation Act, Section 89-3501, et. seq., M.C.A. 1947) places the initiative for flood plain land-use regulation at the local government level and provides for State enforcement of flood plain regulations where local governing bodies fail to act. This program is implemented on a stream-by-stream basis; and to date, about 7,200 stream miles have been established as designated flood plains. The other, the National Flood Insurance Program, has 60 cities, 28 counties, and one Indian reservation participating at present.

These Federal and State programs should be continued and other programs sought to provide a basis for sound flood plain management. On some streams where nonstructural programs are not effective, innovative structural solutions that can be economically justified must be found.

NEBRASKA

To develop sound land-use policies and programs to minimize damages, and to reduce flood damage by the most efficient combination of structural and nonstructural programs.

NORTH DAKOTA

The State's general objective is to limit flooding in urban areas in any one year to one percent; and in agricultural areas, protection against a 25-year flood.

The State's overall strategy for flood damage abatement includes components of flood insurance, flood plain management, and structural/nonstructural features.

SOUTH DAKOTA

The goal is to reduce flood risks to the people of South Dakota.

Water resource management plays a key role in the abatement of flood hazards. Basic hydrographic data collection which is needed for the definition of flood hazard areas should be intensified and made available as soon as possible.

WYOMING

The various degrees of flood hazard damage potential must be identified so that loss of life and property from this cause will be minimized. In this respect, full utilization shall be made of applicable surveys defining specific flood levels and where lacking, the State shall act to acquire such surveys. Full analysis of pertinent data to define extent of risk and economic loss potential shall be developed for use in land-use administration.

FISH AND WILDLIFE

COLORADO

State policy provides that wildlife and its habitat be protected, preserved, enhanced, and managed for the enjoyment of residents and visitors. Colorado's management objectives for wildlife include:

a. maintenance of populations and habitats of all game and wildlife, and to increase the numbers of animals and opportunities for their public enjoyment;

b. acquisition and management of an additional 7,000 acres of statewide cold-water fisheries habitat by 1983 and maintenance of a wide variety of fishing activity including designated fly and/or lure waters, trophy waters, and wild trout waters;

c. implementation of warm-water habitat improvement and corrective stocking to obtain a more desirable mix of panfish species with placement of special emphasis on improving the panfish resource in urban areas to provide a handy fishing opportunity;

d. maintenance of all species in sufficient numbers to ensure the existence of stable, natural communities; and

e. protection of nongame species.

Also, an updated wetlands inventory should be carried out in the Missouri River Basin portion of Colorado by State and Federal

agencies. This inventory should lead to an analysis of the water requirements of critical wetlands and of restoration of certain wetlands. Concurrent studies of riparian habitat necessary to support desired levels and variety of fish and wildlife population should be carried out.

IOWA

Where streams having exceptional recreation and fish and wildlife uses have been designated by the Iowa Conservation Commission, the Iowa Natural Resources Council should place a high degree of protection on these streams by raising protected low flows and provide for strict regulations of water withdrawals and channel changes. The Iowa Department of Environmental Quality also assigns priorities for nonpoint and point-source abatement for these streams.

KANSAS

By law, consideration in planning must be given to means and methods for the protection of aquatic and other wildlife and to the use of water to augment the flow of surface streams for the support of aquatic and other wildlife. No specific State habitat policy is in effect. The State maintains a listing of protected flora and fauna.

MINNESOTA

The Commissioner of Natural Resources, with certain limitations, is empowered to extend protection to any species of wildlife by limiting or closing open seasons and areas of the State or by reducing limits whenever these actions are necessary to guard against undue depletion or extinction or to promote the propagation and reproduction of such animals.

Valuable natural habitat areas of rare and endangered species of plants, wildlife, and fish should be preserved. Remaining areas of natural habitation should be wisely used, and measures protecting these areas should be established.

MISSOURI

Missouri intends to provide for the control; management; restoration; conservation; and regulation of the bird; fish; game; forestry; and all wildlife resources of the State, including hatcheries; sanctuaries; refuges; reservations; and all

other property owned, acquired, or used for such purposes and the acquisition and development thereof, and the administration of all laws pertaining thereto.

MONTANA

The State's principal objective is to protect, perpetuate, enhance, and regulate the wise use of fish and wildlife resources for public benefit now and in the future. Fish and wildlife resources are an important part of the heritage of Montanans and have been a source of enrichment to the quality of their lives.

Montana allows for the protection of instream values through the reservation of water instream.

NEBRASKA

To perpetuate and enhance the fish and wildlife resources of Nebraska for recreational, esthetic, educational, and scientific use.

To manage and preserve areas which are significant in providing wildlife habitat, public hunting or fishing, and natural or scenic features unique to a region.

To provide surface waters that are esthetically pleasing and capable of supporting diversified aquatic life.

NORTH DAKOTA

The State's general objective is to maintain and enhance fish and wildlife habitat. The continued acquisition of waterfowl habitat through fee title, easements, and/or additions to the national wildlife refuge system is a controversial issue in North Dakota. The Water Bank Program administered by USDA is seemingly a more acceptable method of preserving wetlands, from the landowner's point of view, because agreement conditions are not perpetual.

Considerable research and analysis is needed to determine the relationship between supply and demand and the value of benefits derived from maintaining habitat.

The State is extremely concerned about the Federal Endangered Species Act and its capricious application.

SOUTH DAKOTA

The State of South Dakota, acting in the public interest, will provide and protect to the maximum possible extent, the State's water resources which are necessary for the benefit and conservation of wildlife and constitute a meaningful esthetic environment.

It is the policy of the State to recognize that water in lakes for fish, wildlife, recreational and esthetic purposes is in the public interest. The State is currently working to establish a policy for fish, wildlife, recreational, and esthetic purposes.

In addition to the preservation of areas of self-perpetuating plant and animal communties, water resources should be managed to provide additional fish and wildlife habitat to meet fishing and hunting pressures and to compensate for the diversion of lands into other uses. Compensation could include hatchery stocked fish, water-level maintenance, construction of lakes and wetlands, and planting of browse.

WYOMING

All Wyoming wildlife and their habitat are to be managed in such a manner that wildlife maintains a density and distribution which will provide optimum sustained recreational, scientific, educational, esthetic, and economic benefits to the public under the direction of the Game and Fish Department and in cooperation with other landowners and land management agencies. To this end, planning functions undertaken are to be based on evaluation of long-term capabilities, changing social and environmental conditions, and the best possible appraisal of projections and expectations of the future. In the performance of this function, proper consideration shall be given to legal responsibilities, stated policies, areas of conflict, and needs for coordination with all levels of government, private enterprise, and the public at large.

IRRIGATION

COLORADO

Planning objectives regarding irrigation development are as follows:

a. Agriculture is a renewable resource vital to the State's economy and should be preserved and enhanced. Conversion of prime agricultural land and water suitable for irrigated agriculture to nonrenewable uses should be prevented.

b. Irrigators and irrigation water companies should be assisted to make the maximum efficient use of water supplies which are presently utilized. Such efforts could take the form of canal system rehabilitation and on-farm assistance with more efficient irrigation systems. Efforts should also include the construction of storage facilities to reduce seasonal fluctuations in irrigation water supply. The potential for ground-water recharge should be fully examined in areas suitable for such a program. Federal and State programs to accomplish these programs should be implemented.

c. (Applies to Platte-Niobrara Subbasin) Implementation studies should be undertaken to determine the feasibility of constructing storage facilities on tributaries of the South Platte River. Authorized storage projects on the main stem of the South Platte River should be constructed at the earliest practicable time.

d. A State water management system should be developed which provides an adequate supply of high-quality water to all areas that have ecological, agricultural, industrial, and human need; and which recognizes the social and economic impact of distribution and use. Water conservation methods should be strongly encouraged by agricultural users.

IOWA

Iowa's goals for irrigation development provide that an evaluation of the impacts of irrigation uses of water must be conducted for each basin and subbasin before water resources can be allocated for this use. For each irrigation development, the geographical areas of benefit, availability of water, and the water use efficiency must be clearly established with western and northwestern Iowa receiving first consideration for agricultural water supply and irrigation studies.

The State goals further provide that individual farm irrigation system development should be funded from private sources with public funding only being considered when increased production of food and fiber is considered in the general public interest. Farm operations are encouraged to use water conservation management practices to assure the best crop yields within given precipitation probabilities.

KANSAS

Kansas encourages and promotes the maximum beneficial use, control, and development of the water resources of the State. Further, the State has the objective of developing in the near term at least additional 1.9 million acre-feet of water to meet the increased needs of Kansas irrigators. Another objective for irrigation is to reduce the rapid decline of ground water reserves being withdrawn for irrigation in western Kansas, possibly through conservation and recharge practices.

MINNESOTA

Agricultural irrigation involving consumption in excess of 10,000 gallons is the third priority for appropriation and use of water.

Appropriation permits for agricultural irrigation are issued on a case-by-case basis and permits are to be issued only when proposed soil and water conservation measures are adequate and the water supply is available without reducing water levels beyond the reach of properly constructed vicinity wells.

MISSOURI

Missouri intends to provide for protection of, and to foster and develop, the agricultural resources of the State.

MONTANA

New irrigation development is supported generally where it is economically viable and environmentally sound. Substantial water shortage problems now exist in a number of subbasins in Montana, and irrigation is projected to expand steadily through the near-term future. Montana has not indicated a preferred level of new development for irrigation. The recommended plan eventually developed in the Upper Missouri Level B Study and decisions made by the Board of Natural Resources and Conservation

on water reservation applications in the Yellowstone River Basin will establish desirable limits and specify the amount of new irrigated acreage in the Missouri River Basin.

Preliminary estimates indicate that irrigated acreage in the entire Missouri River Basin in Montana may increase by 400,000 acres in the next 20 years.

One of Montana's objectives is to conserve a small percentage of the water normally used for irrigation. This conservation effort could supply all the needs of the State's residential and industrial users. Conservation in irrigation water use, while it must be approached cautiously, will become increasingly important in the future.

NEBRASKA

To promote the sound development and wise use of available water supplies, both surface and ground water, for irrigation to maximize net economic, social, and environmental benefits to the public. The State has encouraged irrigation for many years. State statutes enacted in 1895 declare previously unappropriated water to be the property of the public, dedicated to the use of the people, subject to appropriation; and declare that the use of water for irrigation is a natural want.

NORTH DAKOTA

A North Dakota objective is to continue to encourage and promote irrigation development through both the public and private sectors. Impatience on the part of landowners with the length of time it takes to develop a public project has brought about an acceleration in private development using ground water where available. For those areas lacking the ground-water resources, project type delivery systems are needed.

Rehabilitation of older surface water irrigation systems offers some opportunity for conservation as does the more efficient use of ground water. Conservation tends to evolve as technology and on-the-land experience expands. Meters are required on all irrigation wells. Annual water-use reports are required as well.

Discussions are being held at the State level regarding acreage limitations on non-Federal systems which incorporate surface and/or ground water.

SOUTH DAKOTA

It shall be the policy of South Dakota to encourage the development of the State's irrigation potential. An adequate supply of water should be provided for irrigation projects. Diversion of water from the main stem of the Missouri River to provide water for developments is supported. The State shall strive to increase and maintain conservation of water during irrigation activities.

Development proposals should offer reasonable assurance that problems such as erosion, salt build-up, or structural degeneration of soils will not result.

WYOMING

Agriculture and related activities comprise a major contribution to the State's economy. Due to its importance, maintenance of the current level will continue to be a primary State planning objective along with improvement in water supplies and development of additional feasible projects. Development will be encouraged and advantage will be taken of whatever means are available which include Federal, State, local, or private actions. Due consideration will be given to water sources, either surface or ground, and method of application which will be the most efficient and be in compliance with State laws, rules, and regulations. Irrigated agriculture is a source of continuing livelihood when properly maintained and new development to utilize the State's water entitlement can be initiated as the need for food and fiber for the Nation increases and economic conditions warrant.

LAND CONSERVATION AND MANAGEMENT

COLORADO

State and Federal agencies should assist local soil conservation districts, water conservation districts, water conservancy districts, and county and city governments to remedy watershed problems such as flooding, sediment, and impaired drainage. Within the Missouri Basin, several watershed projects and a number of Resource Conservation and Development projects which are pending authorization should be moved forward.

IOWA

Iowa has established a priority system whereby agriculture has first priority for precipitation and the soil moisture resource. Conservation tillage practices, crop varieties, and rotations to encourage infiltration of precipitation into the ground are an integral part of the water management program for the State. Increased attention and support of the soil conservation district and State university extension programs are also a part of the State's water management program.

Agricultural management practices that reduce runoff, preserve and replenish soil moisture, and include water conservation should be implemented. The State soil conservation program should be strengthened. Agricultural land in the State should be protected and utilized in accordance with its capabilities. Permanent soil, less intensive cropping patterns, and properly managed pasture should be adopted to bring soil losses within acceptable limits. Increased State funding of cost-share assistance for these practices is recommended.

Ongoing research and educational programs illustrating and documenting conservation tillage methods as a part of good agricultural management practices should be continued and intensified.

KANSAS

Kansas law states that water planning shall consider local development of watershed conservation when consistent with sound economic and engineering principles. State statutes specifically call for inclusion of 19 million acres of land within watershed programs in the near term.

MINNESOTA

It is the policy of the State of Minnesota to provide for the conservation of the soil and soil resources of the State, for the control and prevention of soil erosion, for land resource planning and development, for implementation of land-use practices that effectively reduce siltation and loss of the land base through activities associated with farming, mining, construction, forestry, and other activities of man, and for flood prevention or the conservation, development, utilization, and disposal of water, including but not limited to, measures for fish and wildlife and recreational development, thereby preserving natural resources, controlling floods, preventing

impairment of dams and reservoirs, assisting in maintaining the navigability of rivers and harbors, preserving wildlife, protecting the tax base, and protecting public lands by land-use practices.

MISSOURI

The State of Missouri intends to provide technical assistance to develop and carry out programs to ensure that the use and conservation treatment of Missouri's water and land is in harmony with its capability and needs. The State will continue to conduct training and coordinate activities with water conservation districts and assist in the organization of new watershed subdistricts; inventory Missouri's soil resources with modern soil surveys at the district level; and implement land reclamation laws that ensure current and expanded mining operations meet environmental reclamation standards and promote the reclamation of abandoned mine lands.

MONTANA

The Department of Natural Resources and Conservation will continue to consider applications for accelerated land management under the 1975 Montana Renewable Resource Development Program. Increased attention will be given to identifying specific benefits associated with land conservation measures, specifically new farming techniques, and improved forest and range management practices, so that expanded programs can be adequately funded.

Statewide and regional section 208 water quality management planning recommendations regarding nonpoint source pollution and land treatment practices will be implemented where practicable.

NEBRASKA

To conserve the State's land resources by improving land treatment and implementing conservation programs and technologies.

NORTH DAKOTA

The State has an objective which endorses the concept of accelerated land treatment. Many State studies, now completed, support land treatment measures. The State continues to support the concept of completing the necessary bank stabilization measures in two areas: from Garrison Dam to the upper reaches of

Lake Oahe (in Western Dakotas Subbasin); and on the Yellowstone River in McKenzie County (in Yellowstone Subbasin); and in other areas.

SOUTH DAKOTA

South Dakota shall strive to maintain productivity of soils. Effective land conservation and management measures should be practiced to control erosion and reduce the sediment loading from nonpoint source discharges. Incentives should be provided for land disturbers to implement the best land-management practices.

Completion of soil surveys should be accelerated so the data are available to aid land conservation efforts.

WYOMING

All land development proposals are to be given due analysis to assure optimum water and land resources conservation practices are incorporated in the plan of implementation. An inventory of all lands should be developed which would define the various types of lands and their most suitable use, along with the extent and location of renewable and nonrenewable resources to be employed as guidelines in the administration of programs relating to water and land resources. Full advantage shall be taken of State and Federal assistance activities which are oriented to the promotion of conservation practices.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

COLORADO

Improvement of the quantity and quality of municipal, industrial, and rural domestic water supplies should receive increased emphasis in water planning efforts. Federal and State agencies with responsibilities in water resource management should cooperate with local water entities to develop systems that will supply the needs. The water supply systems should make coordinated use of available surface and ground water, and the overall water resource management program should employ conservation and recycling measures to reduce the per capita use. Moreover, the water supply systems, where possible, should be embodied in multipurpose projects formulated by means of the multiobjective planning concept.

IOWA

Studies should be continued on the overall feasibility of rural agricultural water distribution systems. As appropriate, State technical and educational assistance should be provided for the development of rural agricultural water distribution systems to serve areas where livestock water supplies are inadequate or unsuitable. Planning assistance is the first priority need followed by construction funding assistance from local, and Federal sources. Such assistance should include information related to water availability and quality, management practices, and cost/benefit analyses.

Municipalities, rural water associations, and other water users should be required to adopt water conservation measures prior to the point when streams reach the protected low flow or, in the case of lake sources, when water levels reach a specific level below the established lake elevation.

Iowa should establish a goal to achieve optimum development of water supply capability in all Federal reservoirs. The State should encourage and insist that the Federal Government give water supply storage an equal status to flood control, recreational development, and other beneficial uses with a corresponding cost allocation equalization.

State agencies responsible for water resources management should develop programs that promote water recycling in industrial applications and use of treated wastewaters which have suitable quality for irrigation.

All municipalities and rural water districts should be required to furnish proof that they are developing a water supply disaster contingency plan prior to being granted a water withdrawal permit by the Iowa Natural Resources Council. Both normal conservation practices and emergency rationing plans should be included.

KANSAS

A general objective is the protection and improvement of the quality of the water supplies of the State. State policy further calls for provision of sufficient, reliable water supplies for present and future use within the State. Specifically, Kansas law calls for:

a. the development in the near term of at least an additional 185,000 acre-feet of water to meet the increasing annual needs of Kansas municipalities;

b. the development in the near term of at least an additional 750,000 acre-feet of water to meet the increasing annual needs of Kansas industries; and

c. the development of adequate water supplies for small communities and rural users.

MINNESOTA

Minnesota's water resources shall be developed to assure maintenance of a supply from surface- or ground-water sources or from a combination of the two which is adequate to meet long-range seasonal requirements for domestic, municipal, agricultural, power, recreational, navigable, fish and wildlife, and quality-control purposes.

In order to conserve public water supplies during periods of critical water deficiency, public water supply authorities appropriating water shall adopt and enforce restrictions consistent with rules adopted by the commissioner of natural resources within their areas of jurisdiction to restrict lawn sprinkling, car washing, golf course and park irrigation, and other nonessential uses, together with appropriate penalties for failure to comply with the restrictions.

The establishment of rural water supply systems is neither encouraged nor discouraged by the State.

Domestic water supply, excluding industrial and commercial uses of municipal supply, is the first priority for appropriation and use of water.

Uses other than domestic, agricultural irrigation, and power, consuming in excess of 10,000 gallons per day, are fifth priority.

MISSOURI

Implement training and technical assistance programs, monitor the quality of finished water, review plans for the construction of water supply facilities, and inspect water supply systems to maintain the purity of drinking water, are all items to improve Missouri's water supply.

MONTANA

A State objective is to solve reasonable municipal, industrial, and rural domestic water supply demands and to ensure that Montana's water quality standards are met. Small communities should be made aware of potential sources of funds that can be used to secure desirable water supplies.

NEBRASKA

To improve or provide water treatment and distribution systems for municipal, industrial, and rural uses in areas of need.

NORTH DAKOTA

A State objective is to meet water supply demands wherever it is economically feasible.

SOUTH DAKOTA

Water in adequate quality and quantity shall be provided to meet municipal, industrial, and rural domestic needs based upon population, currently discernible location trends, and levels of use determined by "state of the art" water treatment and conservation technology. South Dakota shall strive to increase and maintain the conservation of water used for municipal, industrial, and rural domestic water supply. Diversion of water from the main stem of the Missouri River to provide water for these needs shall be supported.

A policy of the State shall be to assist local governments in providing safe drinking water by providing State technical, administrative, and financial assistance.

Another policy of the State shall be to support the coordinated development of rural water systems and ensure that their development is carried out in accordance with local plans and growth policies.

WYOMING

Under present circumstances and where weather conditions are near normal, water supplies to meet existing needs are generally adequate. Water quality in some of the smaller communities,

however, is at times a matter of concern, mainly because of inadequate facilities for treatment to conform to water quality standards. With the advent of industrial development and its related population expansion, there are situations developing which will require assertive action for positive resolution. There is available to the State sufficient water to satisfy projected needs for some time to come, although in many instances, it is not located in the area where it might be needed. Much of the potential supply comes from the snowmelt during the spring season and consequently, does not remain in an available status for a very long period of time. Currently, some of these needs are being satisfied through transfer of water rights from irrigation uses. A sound State water plan providing for development of feasible storage, employment of proven practices for conservation, efficient use, and distribution that will enable assurance of adequate water supplies will assure that development can be implemented on a firm basis.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

COLORADO

Federal and State agencies should complete a program of identification of nationally significant natural areas in connection with the national landmarks program and comparable State programs. There is also the need for the initiation of comprehensive inventories and analyses of natural lakes to identify more definitely those with high recreational, natural, and fish and wildlife values.

IOWA

Iowa's natural lakes must be protected. No new allocations of water from these lakes should be allowed, and current users should not be allowed to make any substantial increases in the current withdrawal rate. Therefore, the Iowa Natural Resources Council, by the rule-making procedure, should prohibit any new withdrawals from these lakes and deny any requests for substantial increased withdrawals from current users.

A "scenic rivers program" should be established, staffed, and funded within the Iowa Conservation Commission to carry out section 108A of the State Code for the planning, administration, and maintenance of an Iowa scenic rivers system. Criteria for selection of the scenic river segments will be developed in order to analyze Iowa's rivers, identify segments for inclusion, and

establish priorities for the river segments for detailed planning.

The development of a "scenic rivers program" demands that a higher funding and staffing priority be established for it by both the legislature and the conservation commission.

KANSAS

Water-related natural areas are most often developed through the mitigation and enhancement process during Federal water resources development. State policies presently do not apply to preservation of wetlands or river corridors. Historic and cultural features are protected under State and Federal laws.

MINNESOTA

Development of certain areas of Minnesota possessing important historic, cultural, or esthetic values or natural systems which perform functions of greater than local significance, could result in irreversible damage to these resources, decrease their value and utility for public purposes, or unreasonably endanger life and property. Therefore, the State should identify these areas of critical concern and assist and cooperate with local units of government in the preparation of plans and regulations for the wise use of these areas.

In the effort to preserve the environmental values of the State, outstanding geographical areas possessing historical, architectural, and esthetic values are of paramount importance in the development of the State. Areas with an unusual concentration of distinctive historical and architectural values are threatened with destruction or impairment by ever increasing extensions of urban centers; highways; and residential, commercial, and industrial developments. It is in the public interest...to preserve these historic districts which represent and reflect elements of the State's cultural, social, economic, religious, political, architectural, and esthetic heritage.

MISSOURI

The State of Missouri will develop and provide natural and cultural resource programs for the recreational and educational benefit of present and future generations; identify and provide maximum protection to important and significant natural and cultural history resources; and provide maximum protection for significant cultural resources.

MONTANA

A State objective is to preserve Montana's natural and historic resources.

More than two million acres in Montana's 11 national forests have been classified as wilderness and are part of the National Wilderness Preservation System. These areas are roadless tracts characterized by natural conditions and contain a large share of the State's most spectacular mountain scenery. The public domain lands administered by the Bureau of Land Management and the two national parks in Montana (Glacier and the northern portion of Yellowstone) also have outstanding natural areas. A number of other areas set aside in Montana for the maintenance of natural or seminatural conditions include seven national wildlife refuges, two wildlife ranges, and four rivers in the national wild and scenic rivers system.

Historic sites are an important nonrenewable resource that is commonly overlooked. They are classified into four broad categories: buffalo jumps, pictographs, and Indian camps; trading posts, military outposts, missions, and battlegrounds; mining towns; and historic sites related to past art, commerce, religion, transportation, political, and exploration activities.

While water resource planning standards give equal weight to environmental and economic development concerns, it is apparent that sufficient information to consider these natural, historic, and cultural resources is not always available. This inequity should be corrected.

NEBRASKA

To preserve and enhance the environment, health, and welfare of the State's residents by the conservation, protection, development, and management of the State's natural, historic, scientific, and cultural resources.

To provide appropriate protection to selected river reaches and water-related areas of historic, scientific, and cultural value by designation of protected rivers.

NORTH DAKOTA

The State's objective is to preserve natural, historic, and cultural resources. The State's review process for water developments provides the necessary coordination for the preservation of these resources.

SOUTH DAKOTA

South Dakota shall maintain key or unique natural systems on a perpetual basis. Water resources in a few key places should be managed so as to continue the existence of indigenous plant and animal communities. Examples of natural areas and their ecosystems should be left in some areas of the State for the benefit of future populations.

The policy of the State shall be to recognize that water in lakes for recreational and esthetic purposes is in the public interest.

A system of wild, scenic, and recreational rivers shall be implemented in accordance with South Dakota compiled laws 46-17A-14.

WYOMING

Proper consideration must be given to natural, historic, and cultural resources in all water and related resources planning functions in order to assure that these features will continue to be available for future generations. The value of natural, historic, and cultural resources in relation to current society are acknowledged as a significant contribution to the standard of living. Inventories are being made for the identification and classification of this category of resources.

POWER AND ENERGY

COLORADO

Colorado policy states that energy needs should be addressed without irreversibly degrading the environment or water resources. Energy conservation is a goal of the State.

IOWA

Electric energy development in the State should depend on the surface water resource because of the high rate and large quantity of water required for a power plant cooling system.

Small plant requirements may be met by ground water as well as tower makeup demands for plants with 100 MW capacity or less.

Any increases in power or other comparably heavy industrial water use other than from the alluvial aquifers along border streams can be provided from ground water in Iowa after careful evaluation of the impacts has been made on the available supplies. Any surface withdrawals for these uses on the interior streams of Iowa must be predicated on providing adequate storage.

Prospective future electric generating plants should fully consider State water quality standards for thermal discharge in their site selection process.

On interior streams of the State, closed-cycle cooling should be encouraged in order to eliminate any adverse impact on the aquatic habitat.

The State should encourage power interests to locate major generation facilities on the border streams or consider interior storage along with cooling tower units.

Continued support of the Iowa Energy Policy Council's policy energy conservation program is recommended as an aid in controlling the amount of water which must be withdrawn and used for energy production.

Energy studies should include an evaluation of the low BTU gasification potential as a means of using Iowa coal in an environmentally acceptable fashion.

Before a large scale, high BTU gasification facility is considered in Iowa, a careful study should be made in order to assess the associated water and land resource problems.

The State should fund a thorough study to determine the effect of water quality that would result from increased strip mining. Such a study should also include the development of guidelines and recommendations for the DEQ to use in adopting rules, standards, policies, and criteria necessary to protect water quality.

KANSAS

Hydroelectric power potential has been addressed at most water development projects in the State. Kansas terrain and

priorities for water use for more beneficial purposes deter hydro considerations. Policy regarding use of cooling water is dictated by the economics of each situation. Thermal discharges are regulated by State and Federal laws.

MINNESOTA

It is the policy of Minnesota to site large electric power facilities in an orderly manner compatible with environmental preservation and the efficient use of resources. Sites should be chosen that minimize adverse human and environmental impact while ensuring continuing electric power system reliability and integrity and ensuring that electric energy needs are met and fulfilled in an orderly and timely fashion.

The legislature finds and declares that the present rapid growth in demand for energy is in part due to unnecessary energy use; that a continuation of this trend will result in serious depletion of finite quantities of fuels, land and water resources, and threats to the State's environmental quality; that the State must ensure consideration of urban expansion, transit systems, economic development, energy conservation, and environmental protection in planning for large energy facilities; that there is a need to carry out energy conservation measures; and that energy planning, protection of environmental values, development of Minnesota energy sources, and conservation of energy require expanded authority and technical capability and a unified, coordinated response within State government.

The legislature seeks to encourage thrift in the use of energy and to maximize use of energy-efficient systems, thereby, reducing the rate of growth of energy consumption, prudently conserving energy resources, and assuring statewide environmental protection consistent with an adequate, reliable supply of energy.

The State of Minnesota will oppose any actions that will severely impair hydropower production on the Missouri River or its delivery to current Minnesota users.

MISSOURI

Missouri is determining the location and characteristics of Missouri's energy resources in order to provide information needed for their orderly development and management. The State promotes the utilization of alternative energy resources for

industry, business, institutions, and residential customers; and promotes energy-efficient practices and energy conservation for building modifications for new and existing buildings and modifications in industrial processes to reduce the State's 1980 projected energy consumption by five percent.

MONTANA

A State objective is to become more involved in activities regarding Federal impoundments in Montana to ensure that changes in hydropower operations are in the best interests of the State.

State law, specifically the Montana Water Use Act and the Montana Facility Siting Act, continues to govern energy-related industrial growth in Montana. The Department of Natural Resources and Conservation will continue to investigate the feasibility of placing hydropower turbines in existing State projects and implement those projects when feasible.

Montana Water Law can affect energy-related water use in several ways; however, two provisions are very specific; water for use in exporting coal in coal-slurry pipelines is not a beneficial use and, therefore, illegal and large water rights may not be changed from agricultural to industrial use.

NEBRASKA

Not stated.

NORTH DAKOTA

The State's policy, in general, regarding the development of hydropower opportunities is affirmative. The obvious opportunities remaining in North Dakota for additional hydroelectric power are those associated with the installation of additional capacity at Garrison Dam and a limited number of pumped-storage facilities, the latter being questionable at this time in terms of economic feasibility. The Corps is now looking at relatively large-scale pumped storage along Lake Sakakawea.

There is great reluctance to support the concept of installing additional capacity at Garrison Dam because of the need for a re-regulation reservoir, its attendant adverse environmental impacts, and because the State should not be asked to sacrifice additional Missouri River bottom lands.

The State's policy regarding cooling water for thermal-generation plants to some extent is a function of water availability.

SOUTH DAKOTA

It shall be the policy of South Dakota to continue to support the diversion and use of waters from the main stem of the Missouri River for developments found to be feasible and desirable. This may limit hydroelectric power generation.

WYOMING

It is intended that a balanced plan of development be prepared for the production of power and energy which would give proper consideration to all activities using water. Operations involved would include thermal, hydroelectric and wind generating plants, coal and uranium mining, synthetic fuel production, and other related minerals development. The production of power and energy ranks in importance with other major activities carried on in the Nation's economic structure necessary for the support of its improved standard of living. With the existence of abundant natural resources, there will be large demands placed on the State in the economic, social, and environmental fields in meeting these demands.

WATER-ASSOCIATED OUTDOOR RECREATION

COLORADO

All water bodies, both public and private, should, to the extent practicable, be made available for recreational uses. Investigations should be made for Federal reservoirs to examine possible structural and operational modifications to meet recreation and fish and wildlife demands. State and Federal agencies should develop plans for and provide technical assistance to local entities to enable them to take the necessary actions to make private reservoir waters available to the public, where feasible.

IOWA

Iowa should expand its investigation and analysis of the water-oriented recreationist and the water-oriented recreation base. The impact of the energy situation should also be considered. The information will be used to determine user needs

and resource capabilities and to formulate management and enforcement techniques.

Iowa should expand the acquisition and development of additional public access facilities to existing flat and flowing recreation waters. Access provisions for the public should take precedence over private landowner access where needs, demands, and public investment so indicate.

Iowa should carefully study the need and suitable locations for new recreational impoundments. Iowa should lend technical assistance to electric utilities and water supply proponents for potential use of their proposed impoundments for public recreation. Potential impoundment sites, regardless of proposed use, should be considered for protection from development by the State. Future water supplies and management may depend upon these sites.

The public's right to use flowing water should be redefined either legislatively or judicially to include the right to float and walk the streambed for recreation purposes.

As part of the State's outdoor recreation program, access and facilities should be provided in recreationally deficient areas. The metropolitan areas of Council Bluffs and Sioux City and the counties south of Council Bluffs to the Missouri border are the most critical areas and should be given top priority. Increased recreational boating demand should be met by using a combination of acquisition of sites, purchase of easements, and expansion and renovation of existing access sites. New flat water areas may ultimately be needed to satisfy the demand for water-oriented recreation facilities in each region and should be considered in this assessment.

The State should develop a mandatory boating certification program that addresses the educational needs for safe boating operations.

Methods to improve the recreational navigation use of the Missouri Oxbow Lakes should be developed and implemented to reduce the user dependency on the river with its attendant swift current and boat safety problems.

KANSAS

State agencies coordinate with Federal entities to operate

Federal reservoirs in a pattern to optimize fishing and fish propogation. Recreation is considered a by-product rather than a primary purpose in State planning; no storage is allocated for its benefit. The State Comprehensive Outdoor Recreation Plan Update will attempt to provide better intra- and interstate data uniformity.

MINNESOTA

Unique natural, cultural, and historical resources of Minnesota provide abundant opportunities for outdoor recreation and education, and these opportunities should be made available to all citizens of Minnesota now and in the future.

Preservation and proper utilization of Minnesota's outdoor recreational resources is becoming increasingly important to the health, welfare, and prosperity of the citizens of Minnesota due to the growing demand for outdoor recreational facilities and the spread of development and urbanization in the State.

Outdoor recreational needs of the people of Minnesota will be best served by the establishment of an outdoor recreational system which will:

a. preserve an accurate representation of Minnesota's natural and historical heritage for public understanding and enjoyment; and

b. provide an adequate supply of scenic, accessible, and useable lands and waters to accommodate the outdoor recreational needs of Minnesota's citizens.

State water access sites shall be established to provide public access to rivers and lakes which are suitable for outdoor water recreation and where the access is necessary to permit public use.

State wild, scenic and recreational rivers shall be established to protect and maintain the natural characteristics of all or a portion of a river or stream, together with adjacent lands possesses outstanding scenic, scientific, historical, or recreational value.

MISSOURI

Missouri is identifying and responding to the outdoor

recreation needs of Missouri citizens in planning, financial, and technical assistance. It is in the process of identifying and acquiring tracts of land for the State parks and historic sites system.

MONTANA

A State objective is to manage Montana's recreational resources to meet present and future demands in a manner consistent with the capability of the resource. Much outdoor recreation in Montana is water related. Approximately 16,000 miles of stream and 3,400 lakes throughout Montana provide the base for current recreation. These and other waters have value for swimming, boating, game fish reproduction, water quality maintenance, and scenic beauty. All government agencies must give consideration to long-range impacts of development and land use on basic resources; and access to both public and private recreation areas should be provided.

NEBRASKA

To provide outdoor recreation opportunities and to manage wildlife resources for the maximum benefit of the people.

To enhance the quality of life and physical environment in Nebraska by encouraging the development of adequate outdoor recreation opportunity by political subdivisions to meet identified regional, county, municipal, or local needs.

NORTH DAKOTA

The State's objective is to encourage the development of water-based outdoor recreation opportunities where feasible. Typically, recreation development occurs in conjunction with multipurpose storage projects. Indirect benefits are achieved through channel snagging and clearing projects, lake improvements, wetland preservation, and other efforts.

SOUTH DAKOTA

South Dakota should provide to the maximum extent possible an adequate quantity and quality of water to meet existing and projected needs of water-oriented recreational users. Development of the State's water-based recreation potential shall be encouraged. The role played by recreation in the overall social and economic welfare of the State is an important one.

Recreational needs should, therefore, be an equal consideration with irrigation, flood control, and other beneficial uses in planning new water impoundment structures. In addition, this consideration should also apply to the management of existing water impoundments, streams, and waterways. By promoting the protection and appropriate utilization of existing and proposed waters, the State can provide a more wholesome recreational, social, and environmental experience for the people and visitors of the State of South Dakota. Water resources should be managed to provide fish and wildlife habitat to meet fishing, hunting, and other public demands for water-based recreational opportunities.

WYOMING

In areas where water resource developments are made, advantage shall be taken to concurrently develop water-oriented recreation potentials. The presence of streams, lakes, and reservoirs create opportunities for recreation which need to be developed and maintained in order that the greatest benefit can be realized from their use. The expanding population resulting from energy related and natural resource development activities is creating added burdens and pressures on available recreation possibilities. Therefore, it is essential that advantage be taken of all feasible expansion of such facilities and that new recreational opportunities be developed.

TRANSPORTATION

COLORADO

Colorado policy and planning objectives concerning slurry pipelines is that the State shall experience no net loss of water in slurry pipeline operations.

IOWA

Iowa should continue to depend on the Federal Government to finance the maintenance of navigation on the Missouri River.

KANSAS

Navigation on the lower reach of the Kansas River is not controlled by Federal reservoir operations. Port development is under local regulation.

MINNESOTA

No Minnesota planning objectives applicable to the Missouri Basin.

MISSOURI

Missouri's policy is to develop and promote the appropriate use of navigable waterways, including development of ports.

MONTANA

The use of water for coal slurry is not a beneficial use.

NEBRASKA

To provide the most efficient and economical transportation systems for maximum public benefit.

NORTH DAKOTA

Water transportation other than for purposes of recreation is nonexistent in North Dakota at this time. The State neither maintains flows or channels for purposes of navigation.

The State has no definitive policy regarding the use of water for slurry pipelines.

SOUTH DAKOTA

It shall be the policy of South Dakota to continue to support the diversion and use of water from the main stem of the Missouri River for developments found to be feasible and desirable. Coal slurry pipelines may be included among these developments.

Navigation of the Missouri is considered as a possible transportation alternative.

WYOMING

The use of stream channels or canals in the State as a means of transportation does not exist and, consequently, no actions are required for flow or channel maintenance for this purpose. There is possibility for utilization of slurry pipelines for transport of minerals which use would require legislative approval.

WATER QUALITY

COLORADO

The Colorado Water Quality Control Act declares that it shall be the public policy for the State of Colorado, "to conserve State waters and to protect, maintain, and improve the quality thereof for public water supplies, for protection and propagation of wildlife and aquatic life, and for domestic, agricultural, industrial, recreational, and other beneficial uses; to provide that no pollutant be released into any State waters without first receiving the treatment or other corrective action necessary to protect the legitimate and beneficial uses of such waters; to provide for the prevention, abatement, and control of new or existing water pollution; and to cooperate with other States and the Federal Government in carrying out these objectives."

The primary objective of the Colorado Water Quality Control Division, Department of Health, is to implement water quality management plans for all waters in the State. Under section 303(e) of P.L. 92-500, the State has recommended feasibility studies for regionalizing waste treatment. State planning under section 208, addressing the effects of all pollution sources, was scheduled for completion in 1979.

IOWA

The State should implement nonpoint source control programs directed toward solving rural and urban nonpoint source pollution.

The Iowa Department of Environmental Quality's livestock waste control program should be supported at a level adequate to carry out a comprehensive program for controlling water pollution from both existing and new livestock and poultry operations.

Agricultural chemicals must be applied at rates and at times that minimize associated nonpoint pollution.

The various water resources' agencies of the State need to appropriate sufficient funds to develop a comprehensive data collection program and annual funds to maintain and update the data base for quality and quantity of Iowa's waters.

Industrial development efforts should encourage the location of high-volume dischargers on streams with adequate waste assimilative capacity so as to not restrict future development. Local governments should consider water quality impacts in planning for domestic and industrial development. Where the assimilative capacity of a stream has been reached, future development must be offset by more stringent waste treatment requirements.

In the design of industrial and commercial facilities, careful consideration should be given to minimizing the amount of waste products that will be generated within the facility.

Where soil conditions, character of the waste, and other conditions permit, land disposal of wastewater and residual sludges are to be encouraged because of economies that can be realized in solving treatment and disposal problems and values that can be attributed to the use of organic waste as a fertilizer supplement and soil conditioner.

A priority should be placed on abatement of pollution in watersheds that impact on public lakes, rivers, and streams with high natural, scenic, recreational, or cultural value. Iowa should institute a 75 percent State/25 percent landowner cost-share funding for erosion control measures above State lakes.

Iowa's primary effort on pollution abatement should be directed toward restricting pollutant inputs into its waters through such methods as:

a. land-use regulation;

b. watershed treatment;

c. improved effluent modification;

d. diversion;

e. shoreline stabilization; and

f. construction of sanitary dump stations for marine holding tanks.

The Iowa Department of Environmental Quality should continue to use discharge permits as the principal enforcement mechanism to assure compliance by each discharger.

More effort should be expended on improvement of treatment plant operation and maintenance. Multiple plant sharing of qualified operators and laboratory facilities should be encouraged, and more technical assistance should be provided primarily through university extension services.

State financial assistance should be provided to small cities where needed to offset the higher per capita costs of community environmental improvements. Consideration should be given to such alternatives as loans, grants, and revolving funds.

Municipalities should practice strict enforcement of local ordinances on sewer, housing construction, inspection, industrial in-house waste recovery, and pretreatment.

KANSAS

A long-range goal of the State is the protection and improvement of the quality of its water supplies. Specific objectives are declared to be:

a. the achievement of Federal drinking water standards for bacterial, chemical, and physical quality characteristics for public water supplies;

b. the maintenance of the quality of water in water courses within the State so that the dissolved oxygen never falls below five milligrams per liter and the maximum water temperature each day during the summer months does not exceed 90 degrees Fahrenheit ($90^{\circ}F$);

c. the development of irrigation waters in such a manner so that the sodium-absorption ratio does not exceed 15 and the specific conductance does not exceed 750 micromhos;

d. the plugging of abandoned wells and control of seepage areas through which mineralized waters can pollute supplies of useable surface and underground waters;

e. the disposal of all brines in a manner that will not pollute supplies of useable surface and underground waters;

f. the reasonable freedom of water courses from toxic substances and oils; and

g. the proper treatment and release of sewage and industrial wastes in accordance with the assimilation capacities of those water courses into which wastes are discharged.

MINNESOTA

It is the policy of the State to provide for the prevention, control, and abatement of pollution of all waters of the State, so far as feasible and practical, in furtherance of conservation of such waters and protection of the public health and in furtherance of the development of the economic welfare of the State.

No sewage or other matter that will impair the healthfulness of water shall be deposited where it will fall or drain into any pond or stream used as a source of water supply for domestic use.

MISSOURI

Protect, maintain, and improve the quality of the waters of Missouri.

Objectives:

a. Implement a statewide Water Quality Management Plan to control nonpoint sources of water pollution. This will involve the development of future projects concerned with sludge management, noncoal mining, ground-water protection, and pretreatment.

b. Issue permits for the construction and operation of waste-water treatment facilities, and monitor treated effluents for compliance with permit conditions.

c. Seek positive enforcement action against facilities which fail to comply with permits or respond to confluence, conciliation, or persuasion.

d. Monitor selected streams and lakes to determine existing water quality, and identify the need for pollution abatement. Monitoring results will be published in an biennial quality report.

e. Develop a pretreatment program to control, at the source, those contaminates which may inhibit the waste-water treatment process or which may pass through the treatment process and have a toxic effect upon aquatic life within the receiving waters.

f. Review and revise existing regulations where necessary.

g. Review and revise water-quality standards based upon monitoring results and other data.

h. Provide for comprehensive training of waste-water treatment operators and certification of same.

i. Initiate the development of an electronic data-processing system for storing, sorting, and retrieving vast quantities of water-quality data as well as permitting and compliance functions.

j. Develop mechanisms for internal evaluation of program effectiveness.

MONTANA

A State objective is to eliminate the major cause of point source pollution through the State's Wastewater Discharge Permit Program and EPA's Construction Grant Program.

Implementation of the Water Quality Bureau's five-year strategy which includes the following: monitoring programs, correction/abatement programs, and assessments of remaining problem areas (agricultural nonpoint pollution, silviculture nonpoint pollution, mining nonpoint pollution, residual waste disposal pollution, and construction nonpoint pollution) will require continued funding. Correction of Montana's water-quality problems is a goal for water-quality managers and Montana's citizens.

NEBRASKA

To maintain adequate streamflow of acceptable quality to provide optimum use for agricultural, municipal, industrial, and other beneficial uses in cooperation with neighboring States.

NORTH DAKOTA

The State objective is to improve water quality to the standards specified in various government regulations. Water quality is being addressed in the statewide 208 study as well as other ongoing State and Federal programs. The problems addressed in various studies will be resolved through the enactment of new State legislation and administration of technical and financial assistance programs.

SOUTH DAKOTA

South Dakota shall strive to increase and maintain water quality allowing for present and prospective uses of surface and ground water.

The necessity of providing water of sufficient quality to meet a designated beneficial use is recognized by requirements of South Dakota and Federal law. The availability of water of proper quality may have a serious effect on the costs or feasibility of a future use. The primary means of achieving this objective is through treatment of point source discharges and adherence to proper land management to reduce the pollutant load from nonpoint source discharges. Toxic and other harmful waste discharges which detract from water quality or land useability should be eliminated.

Implementation of effective land conservation measures for control of erosion and siltation shall be encouraged by the State. The State should aid feedlot operators and local governments to comply with water quality standards through State technical, administrative, and financial assistance in the construction of pollutant control facilities. Incentives shall be provided to land disturbers to implement best management practices to reduce nonpoint source pollution.

It shall be the policy of the State to encourage the use of stored waters for water quality enhancement and stabilization of streamflows provided that such enhancement will not be used as a substitute for compliance with effluent standards. While dilution may be a means of controlling water quality, it does not meet the needs for control of manmade or man-caused pollution.

In making public investments, the State shall attempt to enhance water quality or at least to minimize the degradation of water quality.

WYOMING

Water quality is a factor of prime importance to the State and specific State functions are conducted to assure that water quality is maintained and improved where practical. All point discharges are subject to control and are administered under a permitting system providing positive regulation to assure conformance with State and Federal requirements. Water quality management plans for the State will be implemented in conformance with P.L. 92-500, the Federal Water Pollution Control Act, as amended. Upon completion and adoption, all discharges will be subject to control and treatment measures where necessary. The basic objective on which the State plan is developed is to conform to the extent feasible with the national standard for all waters to be fishable and swimmable.

LEGAL AND INSTITUTIONAL FACTORS

COLORADO

a. Beneficial Use

The Colorado Constitution declares that the right to divert and put unappropriated water to beneficial use "shall never be denied." Uses specifically recognized as "beneficial" are domestic, agricultural, industrial, municipal, and recreational, although others have been recognized.

The State recently enacted legislation expanding "beneficial use" to include appropriation by the State of minimum levels in streams or on lakes as required to preserve the natural environment to a reasonable degree.

b. Priority

The Colorado Constitution provides that whenever the waters of any natural stream are not sufficient, those using the waters for domestic purposes shall have preference over those claiming for any other purposes, and those using the water for agricultural purposes shall have perference over those using the same for manufacturing purposes. The courts have held that the preference is not self-executing but must be exercised by condemnation. Through the condemnation proceedings, the preferred user, or condemner, is required to make just compensation to the defendant whose right is invalidated even though it be senior in priority.

c. Reserved Waters

Major problems exist concerning the scope and procedural mechanisms for quantification and adjudication of Federal reserved water rights. Colorado does not oppose the principle of lawful and reasonable reserved rights and wants to see them quantified, limited to the authorized purposes for which they were intended, adjudicated, and integrated into the State system for management of water rights, based on priority of appropriation.

IOWA

Support legislation to make the scenic rivers program viable must be enacted to:

a. protect critical water areas;

b. compel county and municipal zoning to meet minimum State guidelines along designated river segments;

c. empower the Conservation Commission to condemn, for less than fee title those areas having outstanding scenic or natural characteristics to ensure equitable treatment of all landowners along a designated river segment and to protect the public values possessed by such river reaches;

d. empower and provide funds for the State to reimburse local governments with taxes lost as a result of public acquisition for the scenic rivers programs in fee or less than fee title;

e. require county assessors to adjust property to reflect changes in values resulting from perpetual conservation easements acquired by governmental units for public benefit; and

f. continue the open space funding program.

KANSAS

Beneficial water-use purposes in Kansas include but are not limited to domestic, stockwater, municipal, irrigation,

agricultural, industrial, streamflow regulation, public recreational and fish and wildlife, water power, and navigation. Where uses conflict, the date of priority of an appropriation right, and not the purpose of use, determines the right to divert and use water at any time when the supply is not sufficient to satisfy all water rights that attach to it. All waters belong to the people of the State, subject to regulation by the State. Kansas does not impose restrictions on interbasin transfer of waters; such transbasin diversions exist presently. Kansas' major interstate streams are compacted by Federal decree.

MINNESOTA

No water appropriation permit shall be issued under section 105.41 of Minnesota law unless it is consistent with State, regional, and local water related land resources management plans provided that regional and local plans are consistent with statewide plans.

No application for use of surface waters of the State for any purpose is complete until the applicant submits, as part of the application, a contingency plan which describes the alternative he will utilize if further appropriation is restricted due to the flow of a stream or the level of a water basin. No surface water appropriation shall be allowed for any purpose unless the contingency plan is feasible or the permitee agrees to withstand the results of no appropriation.

Diversions of water from the State for use in other states or regions shall be discouraged.

MISSOURI

The State will determine the needs and effective mechanisms for allocation of basin waters between basin States.

MONTANA

The State's principal objective is to assume responsibility for the utilization, development, and conservation of water and related land resources in Montana. In order to implement this objective, it is essential that all water-use requirements be quantified in a reasonable and equitable manner and that water quality and quantity planning and management be integrated. Montana Water Law must recognize and help resolve problems associated with current water appropriation problems.

Montana State government is the focal point for water resource planning and management functions.

NEBRASKA

In the 1978 session, the legislature directed the Natural Resources Commission to cooperate with other State agencies to prepare a Work Plan for redirecting and accelerating development of the State Water Plan and to place a high priority on the analysis of water policy issues. The policy issues being addressed are:

a. instream flows;
b. water quality;
c. ground water reservoir management;
d. water use efficiency;
e. surface and ground water rights; and
f. municipal needs.

NORTH DAKOTA

Beneficial uses based on State law include domestic, municipal, livestock, irrigation, fish and wildlife, and other outdoor recreational uses. Water-use priorities are as listed.

The State has no definitive policy regarding transbasin diversions. State law does authorize the Water Commission to reserve water for specific future uses.

The State objective on interstate water allocation provides for each State to fully identify its future needs and to evaluate other less restrictive remedies before concurring on the allocation of interstate waters.

SOUTH DAKOTA

It shall be the policy of South Dakota to continue a high level of participation and leadership in all regional planning, river basin commissions, and water compacts.

The State shall continue to assert its rights to interstate waters.

The State shall take an active role in insuring rapid and beneficial development of the State's water and related land

resources and encouraging multipurpose use of those resources whenever possible. Environmental benefits and costs should receive equal weight with economic benefits and costs consistent with the development goals of this State. A water project may be rejected if further water quality degradation of any waters will result unless the project demonstrates substantial economic and social benefits.

In the event the water supply in any of the basins in South Dakota is not sufficient to meet all the objectives, the State will attempt to resolve the issues in such a manner that will be beneficial to the majority of the citizens of the State.

Interbasin transfers of waters for feasible and desirable uses will be allowed ensuring that the needs of South Dakotans are provided for.

WYOMING

Although the headwaters of many streams are located in Wyoming, the State does not have free, unrestricted use of the streamflows. The major streams are regulated in their use between States by negotiated compacts or court decrees which define the quantities of water to which each State is entitled. Within the limits prescribed by these documents, administration of the use of water, which by State constitution is declared to be the property of the State, is conducted in accordance with State law. The State administers water use on the priority of appropriation for beneficial application. Change in use can be effected where the amount of historical consumption is not changed and other existing lawful appropriators will not be injured in any manner.

Beneficial use is established as the basis, the measure, and the limit of the right to use water at all times as the purpose of use is defined in the permit application. The order of preferred use is: First - water for drinking purposes for both man and beast; Second - water for municipal purposes; Third - water for the use of steam engines and for general railway use, water for culinary, laundry, bathing, refrigerating, for steam and hot-water heating plants, and steam power plants; and Fourth - industrial purposes. Wyoming statutes make an exception to the order of preferred uses stating that water for irrigation is superior and preferred to any use where water turbines or impulse water wheels are installed for power purposes. This preference gives irrigation the right to use water even though it has a junior priority date.

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Other than as stipulated in some of the compacts, State water law does not prohibit transbasin diversions. In those basins which are not prohibited by compact, any transbasin diversion could be effected by compliance with all aspects of the State's water law governing change in use and point of diversion actions.

It is the position of the State that water rights for Federal lands, including Indian reservations, should be administered in accordance with State procedures as managed by State agencies. Federal rights are based on claims that water was also reserved in the amounts necessary for the needs and purposes of the lands for which they were established and the date from the time the lands were so designated. Since the magnitude of Federal claims has not been defined, planning functions are hampered by uncertainty of projected amounts of water that will be available for future uses. To be able to proceed on a sound basis, it is essential that the administration of water use in the State be under the jurisdiction of a single agency.

INSTREAM FLOWS

COLORADO

The State recently enacted legislation expanding "beneficial use" to include appropriation by the state of minimum levels in streams or on lakes as required to preserve the natural environment to a reasonable degree. Waters for instream flows need to be filed as a water right.

IOWA

Iowa will maintain a strong interest in the allocation of the water resource of the Missouri River Basin so that Iowa receives its proportionate share for its water supply needs and instream uses including navigation. An allocation plan of the Missouri River waters may be needed and should receive attention by the Missouri River Basin Commission, its member States, and Federal agencies. The State of Iowa will adamantly defend its right to a reasonable portion of the flow of the border rivers. Any major diversions upstream of Iowa will be carefully evaluated to assure Iowa's share of these critical flows.

Iowa should improve and expand the current network of gauging stations to assist in determining instream flow requirements for recreation and fish and wildlife uses.

KANSAS

Kansas law states that water planning shall consider:

a. the use of waters to augment the flow of surface streams for the support of aquatic and other wildlife and to improve the water quality of the stream and to protect the public health; and

b. the inclusion of conservation storage in reservoir development and planning for the regulation of streamflow for the purpose of quality control, such inclusion not to serve as a substitute for methods of controlling wastes at their sources.

Further, it is a goal of the State to include in publicly financed structures for the development, conservation, control, or management of the water resources of the State, of reasonable amounts of storage capacity to augment low flows.

MINNESOTA

Where data are available, permits to appropriate water from natural and altered natural water courses shall be limited so that consumptive appropriations are not made from the water courses during periods of specified low flows in order to safeguard water availability for instream uses and for downstream higher priority users located in reasonable proximity to the site of appropriation.

Permits to appropriate water for any purpose from water basins shall be limited so the collective annual withdrawals do not exceed a total volume of water amounting to one-half acre-foot per surface acre of water basin based on Minnesota Department of Conservation Bulletin No. 25, "An Inventory of Minnesota Lakes."

MISSOURI

Missouri will consider the need and desirability of establishing permit systems for water use in advance of anticipated shortages with full provisions for maintaining adequate quality and environmental uses of natural water.

MONTANA

A State objective is to identify and appropriate adequate instream flow levels for streams in the State. The Montana Water Use Act allows for the protection of instream values through the appropriation of water instream.

NEBRASKA

Not stated.

NORTH DAKOTA

Present North Dakota Water Law does not recognize instream flow as a beneficial use. In the past, planning efforts have acknowledged the desirability of streamflow maintenance for a variety of purposes and have supported storage for these purposes.

A State objective supports efforts to develop methodologies for determining instream flow benefits.

SOUTH DAKOTA

South Dakota shall attempt to provide adequate water quantity to meet existing and projected needs of water-oriented recreational uses. At a minimum, adequate water should be that quantity and quality which meets needs based upon population, currently discernable location trends, and levels of use.

Water resources may be managed to provide water level maintenance for fish and wildlife habitat. Use of stored waters for water quality enhancement and stabilization of streamflows will be evaluated by the State.

It is the policy of the State to recognize that water in lakes for fish, wildlife, recreational, and esthetic purposes is in the public interest. The State is currently working to establish a policy for fish, wildlife, recreational, and esthetic purposes.

WYOMING

The maintenance of instream flows is acknowledged as a

desirable feature and the State fully supports the achievement of such conditions where water supplies are sufficient to do so. Instream flows, however, are not defined by State law as a beneficial use and, consequently, they have no status as a preferred right. Under the criteria of multipurpose planning, full consideration will be given to instream flows to the extent feasible.

WEATHER MODIFICATION

COLORADO

The 1972 Colorado General Assembly enacted legislation governing weather modifications in Colorado. In the enabling act, the General Assembly declared that the State of Colorado recognized that economic benefits can be derived for the people of the State from weather modification and that operations, research, experimentation, and development in the field of weather modification shall be encouraged. The Executive Director of the Department of Natural Resources administers the State program.

IOWA

Not stated.

KANSAS

Weather modification is promoted on the Federal, State, local, and private level in Kansas. All such operations must be licensed by the Kansas Water Resources Board.

MINNESOTA

Minnesota does not currently encourage or promote weather modification activities but does regulate weather modification activities through licensing and permitting procedures to protect its citizens.

MISSOURI

Not stated.

MONTANA

The State's objective is to fully explore the possibility of

augmenting precipitation through Federal and State programs in weather modification. Sufficient research must be conducted to confidently predict the beneficial and adverse effects of snowpack and summer rainfall augmentation projects in Montana.

Snowpack augmentation is of concern to Montana from two points of view. First, for residents of the State, it has the potential of increasing resources of stored water for agriculture and power production as well as creating environmental impacts if conducted over long periods of time. Second, residents downstream and out of State along the Missouri River system have a substantial interest in increasing snowpack runoff from the Montana headwaters.

The augmentation of rainfall from spring and summer cumulus clouds researched through the HIPLEX program may have potential in Montana to increase agricultural production, carrying capacity, and could have environmental impacts if conducted over long periods of time. There are major uncertainties concerning the augmentations of rainfall from summer cumulus clouds.

NEBRASKA

Not stated.

NORTH DAKOTA

The major goals of weather modification in North Dakota are to increase precipitation and suppress hail. In pursuit of these goals, the rights of the public are to be protected, environmentally acceptable procedures are to be utilized, and an assessment of results is to be a continuing process.

SOUTH DAKOTA

Weather modification techniques for precipitation management should be used to augment precipitation and decrease hail damage in South Dakota. The application of weather modification techniques will be carried out under proper safeguards to supply sufficient data and accurate information in order to provide a net economic benefit and enhance knowledge concerning weather modification and to protect life, property and public interest.

WYOMING

Weather modification by State statute is subject to control by the State by the issuance of permits authorizing experiments and research within the State boundaries for this purpose. Such activities from which information may be procured, compiled, and evaluated to determine the value of this type of operation are encouraged.

APPENDIX D – WATER RESOURCES PROBLEMS AND OPPORTUNITIES

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WATER RESOURCES PROBLEMS AND OPPORTUNITIES

This appendix contains descriptions of major water resources problems and opportunities in each of eight subbasins in the Missouri River Basin. Problems and opportunities described during the course of the regional plan update came from many sources, including studies by State and Federal agencies and regional and private entities. Together with planning objectives, these problems and opportunities formed the basis upon which planning recommendations were developed. The order in which each subbasin's problems and opportunities are described in this appendix is as follows:

Upper Missouri Subbasin
Yellowstone Subbasin
Western Dakotas Subbasin
Eastern Dakotas Subbasin
Platte-Niobrara Subbasin
Middle Missouri Subbasin
Kansas Subbasin
Lower Missouri Subbasin

UPPER MISSOURI SUBBASIN

FLOODING

Urban and Built-Up

Spring runoff causes urban flooding at many locations. Some of the more severe problems appear at Great Falls on the Sun River, Roundup on the Musselshell River, and Glasgow and Nashua on the Milk River.

Rural

Rural flooding is common along the Milk, Judith, Musselshell, Sun, Upper Marias and Cut Bank Creek tributaries, and tributaries to the Gallatin, Jefferson, and Madison River. Flooding causes stream bank erosion and often adversely affects irrigation pumps, roads, bridges, fences, and removes land from production.

FISH AND WILDLIFE

Riparian Habitat

Riparian habitat destruction is a major problem on many streams in this subbasin. Major reasons for this loss of habitat are agricultural practices being carried out up to the edge of the stream, livestock pasturing in the riparian zone, highway and railroad development, and second home construction. While recent concern has greatly increased, no comprehensive inventory has been undertaken to identify where specific lands have been damaged.

Fisheries Habitat

The high-quality fishery along Grasshopper Creek and Wise River is threatened by mine drainage from old copper, lead, gold, and silver mines in the area. Thermal pollution in the Madison River below Ennis Lake degraded the quality of that river's fishery. Other problems common throughout the subbasin affecting fisheries include irrigation return flows, erosion due to improper land-use practices, municipal outflows, and dewatering on many streams.

Lake level fluctuations at Fort Peck and Canyon Ferry Reservoirs affect fish propagation.

IRRIGATION

Water Shortage (Ground, Surface)

Irrigated acreage is increasing in this subbasin especially along the Milk River where competition for water use is intense.

Older surface systems throughout the subbasin need rehabilitation to increase efficiencies in water use. However, water users are often unable to finance the improvements.

Late season irrigation water shortages are common. The Big Hole, Milk, and Musselshell Rivers often experience these shortages.

LAND CONSERVATION AND MANAGEMENT

Upland Soil Erosion

Excess water application, improper tillage practices, and overgrazing contribute to wind and water erosion and sedimentation problems in this subbasin. By 1990, it is estimated that there will still be 15,000,000 acres in need of land conservation.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

There are ten communities in the subbasin with population over 3,000 which will need some type of improvement for water supply and/or quality within the next 20 years. The communities and their need are displayed in Table 1 that follows. There are 132 communities (some unincorporated) that have or anticipate problems of water supply or quality before year 2000. The present problems are associated with storage, treatment, and/or distribution facilities for which the smaller communities lack funds.

TABLE 1
COMMUNITY WATER SUPPLY AND QUALITY NEEDS
UPPER MISSOURI SUBBASIN

Community	Water System Needs Upgrade for Increased Supply	Water Quality Problems: Surface Supply Unreliable Quality	Fecal Contamination	Taste and Odor	Total Dissolved Solids
Dillon	X	X	X		
Bozeman	X	X			
Helena	X			X	
Great Falls	X	X			
Cut Bank	X				
Conrad*					
Lewistown	X				
Havre	X				
Glasgow*					
Wolf Point	X				X

* These are unspecified minor water quality problems.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

Development often conflicts with the "natural" values of all streams, including those suggested for designation in the national system of wild and scenic rivers. Water quality degradation, decreased flows, and stream-bank structures are some impairments to the natural condition.

POWER AND ENERGY

Hydroelectric Power Production

The national demands for more power may require assessment of new operating criteria and the possibility of installing additional capacity at dams with hydropower throughout this subbasin.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Access

Tourism is a major industry in the subbasin, requiring sound planning and management. Natural resources need protection for continued attraction. The greatest increase in recreation demand will occur in drainages 1002 and 1003 of the subbasin. The activities with the greatest need for additional facilities, access or lands are: hunting, developed camping, boating, and nonurban swimming. The locations expecting the greatest increase in recreation demand are lands adjacent to Yellowstone Park and the Missouri River segment from Townsend to Cascade, Montana.

WATER QUALITY

Nonpoint Source Pollution

Nonpoint pollution due to erosion, acid mine drainage, saline seeps, improper grazing and logging, and irrigation return flows impair the quality of many subbasin streams. Problems occur on most streams and tributaries throughout the subbasin with one of the severest on Muddy Creek. Approximately 200,000 tons of soil is eroded and transported to the Sun River every year from the lower Muddy Creek drainage.

Point Source Pollution

Most of the point source discharges are from municipal wastewater treatment facilities, specifically primary treatment lagoons. This is an economically suitable treatment method for small Montana communities.

The most noteworthy problems include:

a. East Gallatin River by the Bozeman sewage treatment plant;

b. Prickly Pear Creek by the National Cylinder Gas Company, Hillbrook Nursing Home, Kaiser Cement and Gypsum Company, and Helena Municipal Treatment Plant;
c. Midvale Creek by East Glacier Park and East Glacier Lodge.

LEGAL AND INSTITUTIONAL FACTORS

Reserved Water Rights

Indian and Federal water rights need definition throughout the subbasin in order to plan for future water management.

INSTREAM FLOWS

Determination of Stream Flow Requirements

Through the 1973 Montana Water Use Act, which identifies instream flow as a beneficial water use, Montana has an opportunity unique to the Missouri Basin States to reserve water for instream purposes. Currently there is no program to do this subbasinwide, however, the Fish, Wildlife and Parks Department is collecting data on several streams. Eventually these data will be the foundation for instream reservation applications on many streams or stream segments in the subbasin.

WEATHER MODIFICATION

Precipitation Shortages

There is insufficient rainfall during certain growing seasons. Weather modification research is an opportunity that can be used to provide water at critical periods.

Hail Damages

Hail comes during the growing season and destroys crops. Research in weather modification provides an opportunity to suppress destructive hail.

YELLOWSTONE SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

State comprehensive plans for the management of the water and related land resources in this subbasin should be updated and completed using the data and information from the recent Yellowstone Level B Study and relevant data from State and regional studies.

Interstate

Coordination and implementation of regional water and related land resource plans along the interstate streams in this subbasin require the support and financial assistance of each state.

FLOODING

Urban and Built-Up

Spring runoff causes urban flooding at many locations with some of the more severe problems at Billings and Miles City on the Yellowstone River and tributaries.

Rural

Rural flooding during the spring is common throughout this subbasin.

Flood plain use and development without suitable protection continues throughout the subbasin.

FISH AND WILDLIFE

Fisheries Habitat

Fish passage facilities are needed at the Intake diversion along the Yellowstone River.

IRRIGATION

Water Shortage (Ground, Surface)

Late season shortages are a common problem throughout the subbasin along Powder, Tongue, Clarks Fork Rivers, and Rosebud Creek.

Efficiency (Water, Energy)

Many irrigation systems need extensive rehabilitation to avoid leakage and to improve efficiencies.

Irrigation diversion facilities are hampered by low flows, flooding, and erosion on the Bighorn and Yellowstone Rivers.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Streambank erosion is a problem along the Yellowstone River and tributaries in Montana, Wyoming, and in McKenzie County, North Dakota.

Upland Soil Erosion

Some farming, forest, and range practices contribute to erosion and sediment problems along the Powder River in Wyoming.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

Additional water supplies are needed to meet urban growth in communities such as Lander, Wyoming and Billings, Montana.

Communities in eastern Montana and in Wyoming such as Riverton, Lander, Powell, and Basin need improved water systems as a result of increased population growth and expansion. Many supplies do not meet Federal standards.

POWER AND ENERGY

Hydroelectric Power Production

The national demands for more power may require assessment of new operating criteria and the possibility of installing additional capacity at dams with hydropower throughout this subbasin.

Mining

Energy-related water demands are increasing rapidly in this subbasin. Along the Tongue and Powder Rivers in Wyoming additional storage areas are needed to meet coal and uranium industry demands.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Access

Additional public access to streams and hunting grounds is needed throughout the subbasin to meet recreational demands; notably on the Tongue, Bighorn, and Yellowstone Rivers. In the Miles City area there is a need for additional flat water recreation.

WATER QUALITY

Nonpoint Source Pollution

Irrigation return flows have contributed to increasing stream salinity in the Yellowstone River, near Billings, Montana; the Shoshone River between Lovell and Kane, Wyoming; and generally along the Wind and Bighorn Rivers, in Wyoming.

Silt and salinity problems affect seasonal recreation use of streams in the southern portion of the Powder River Basin.

Point Source Pollution

Oil, grease, and coliforms affect Yellowstone River water quality from Laurel to Billings, Montana. There is a lack of suitable treatment facilities at Sheridan, Wyoming.

LEGAL AND INSTITUTIONAL FACTORS

Reserved Water Rights

Indian and Federal water rights need definition throughout the subbasin in order to plan for future water management.

INSTREAM FLOWS

Determination of Stream Flow Requirements

Instream flow requirements may need to be considered on certain rivers such as the Powder, Wind, and Clarks Fork Rivers in Wyoming.

WEATHER MODIFICATION

Precipitation Shortages

There is insufficient rainfall during certain growing seasons. Weather modification research is an opportunity that can be used to provide water at critical periods.

Hail Damages

Hail comes during the growing season and destroys crops. Research in weather modification provides an opportunity that can be used to suppress destructive hail through research.

WESTERN DAKOTAS SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

There are many water resource problems in the Bad River and White River-Medicine Creek Basins that need resolution by a comprehensive analysis.

In the Black Hills, streams passing over the Paha Sapa Limestone Formation can lose some or all of their water.

Interstate

The data problems in this subbasin include the lack of geohydrologic information in most of western South Dakota. In addition, the inadequate data and information on water resources presents problems of interstate communication and coordination in water resources management.

FLOODING

Urban and Built-Up

Throughout this subbasin, spring runoff causes urban flooding at many locations. The most severe problems occur in Hay Creek and Redwater River at Belle Fourche and the Bad River at Ft. Pierre in South Dakota and in the Cannonball River at Mott, Little Missouri river at Medora, Antelope Creek at Hazen, Heart River at Belfield, and Apple Creek south of Bismarck in North Dakota. In South Dakota, localized flooding occurs at Spearfish, Hot Springs, Box Elder, Hill City, New Underwood, and Keystone. North Dakota communities experiencing localized

flooding problems include Carson, Center, Flasher, Hebron, Halliday, Zap, Beulah, Killdeer, Mandan, Linton, Underwood, Dickinson, White Earth, Parshall, and Napoleon.

Rural

Rural flooding is fairly common along many tributary streams although problem areas may be isolated. The Battle Creek and Bear Butte Creek watersheds in South Dakota are particular problems. In North Dakota, the Heart River near Belfield, and the Apple Creek, Painted Woods Creek, Shell Creek, and the Little Missouri are all problem areas.

Aggradation at the headwaters of Lake Oahe is raising the ground-water table and may cause serious problems in the southern Bismarck area.

FISH AND WILDLIFE

Fisheries Habitat

Heavy sediment loading in the White River is adversely affecting fish and wildlife habitat.

The inadequacy of regular streamflows is a fishery problem in the Western Dakotas.

Fisheries habitat problems are common to all of the main stem reservoirs. These problems are due to pool fluctuations and the resultant lack of near shore vegetation.

IRRIGATION

Water Shortage (Ground, Surface)

Irrigation water shortages occur in Perkins and Corson Counties, South Dakota, and along the Grand River late in the growing season.

Additional water storage for irrigation is needed on the Moreau River in Perkins, Ziebach, and Dewey Counties on the Bad River near Philip; and along the White and Little White Rivers in South Dakota.

Belle Fourche irrigation project is in need of rehabilitation and potentially irrigable lands are located along

the Belle Fourche River below the project that need to be served by diversions from the river.

All streams, except the Missouri main stem, annually exerience water shortages, especially after mid-July with water quality deteriorating as the flow decreases.

Deerfield Dam is in need of modification as a result of reevaluation under the safety of dam program. Revised design flow criteria showed the need to increase the height of the structure and to rehabilitate and reinforce the spillway. Work has been authorized and funds appropriated. Construction to start in 1980.

Sedimentation in Angostura Reservoir is a problem and needs continuous monitoring.

Federally certifiable land irrigation suitability needs to be established for subbasin Indian reservations in order to help establish substantiated Indian irrigation associated water rights.

With the exception of the Pine Ridge Unit, Federal irrigation studies of the Grand, Moreau, Cheyenne, Lower Belle Fourche, Bad, and White Rivers are technologically outdated, being 25 to 40 years old. Irrigation potential needs to be reevaluated.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Bank erosion is a significant problem which is causing the loss of agricultural lands and is threatening residences along the Missouri River between Garrison Dam and Lake Oahe. Severe erosion of agricultural lands also occurs in tributaries such as the White River.

Battle Creek and Bear Butte Creek have erosion and sedimentation problems.

Upland Soil Erosion

Upland erosion problems are especially significant in the Little Missouri, Grand, Moreau, Cheyenne, Bad, and White Rivers.

Saline seeps are a persistent problem in many areas west of the Missouri River.

Sediment Deposition

Sedimentation is a problem in most lakes in the Black Hills and at the headwaters of Lake Oahe.

Higher river levels caused by aggradation are contributing to the high ground water and salinity problems in the headwater areas of the main-stem reservoirs.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

Much of the Cheyenne River Basin has insufficient quantity of good quality surface and ground water for most uses.

The South Dakota communities with water supply (*) and quality (x) problems include:

Philip (x)	Bison (x)	Draper (x)
Midland (x)	Dupree (x)	Kennebec (*)
Belvidere (x)	Isabel (*)	Reliance (x)
Vivian (x)	Lemon (x)	Faith (*)
Kadoka (x)	McIntosh (x)	Belle Fourche (*)
Murdock (* x)	Spearfish (*)	Sturgis (*)
Fruitdale (x)	Edgemont (* x)	Buffalo (x)
Morristown (* x)	Presho (x)	New Underwood (x)
Oacoma (x)	Oelricks (x)	

and in North Dakota:

Zap	Hazen	Dickinson (*)
Bucyrus (*)	Hettinger (*)	Haynes (*)
Amidon (*)	New England	Regent
Mott	Flasher (*)	Beach
Bowman (*)	Halliday	Reeder (*)
Sentinel Butte (*)	Belfield	Gladstone
Taylor	Richarton	Hebron
Manning (*)		

These North Dakota communities have expressed an interest in obtaining a new or supplemental water supply source in the recently completed southwest North Dakota Water Supply Study.

The communities with asterisks (*) have the most severe problems.

Rural Domestic

Ground-water quality for rural domestic uses in most of the area included in the Western Dakotas Subbasin does not meet national drinking water standards.

The quantity of water for rural domestic supply is insufficient in the Bad River Basin.

South Dakota counties of Ziebach, Perkins, and Dewey and the Cheyenne Indian Reservation have poor water quality and insufficient water quantity for domestic and livestock purposes.

Seismic exploration for oil and other minerals is causing or contributing to the loss or impairment of rural domestic wells in North Dakota.

POWER AND ENERGY

Hydroelectric Power Production

There is an opportunity to add additional units to the existing dams and to place some additional pump-back storage hydropower units on the Missouri River and along main-stem reservoirs to meet peak energy needs.

Opportunities exist for water development in western South Dakota for energy and other industrial uses.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

Water management practices at the Missouri River main-stem reservoirs often cause lowered recreational opportunities and the loss of aquatic habitat.

Water Access

There is a shortage of public access points at Lakes Sakakawea and Oahe in North Dakota for water-oriented recreation uses.

Lack of Facilities

There is a shortage of water-oriented recreation facilities in the Cheyenne River Basin.

There is a need for fishing areas and swimming beaches closer to the population centers throughout the Western Dakotas Subbasin.

In western South Dakota, power boat facilities and ski beaches are needed.

WATER QUALITY

Nonpoint Source Pollution

The Heart and Little Missouri Rivers have high concentrations of nitrates, phosphates, TDS, and coliforms.

Coliform bacteria often indicate point pollution sources such as feedlots. However, cattle grazing over large areas "may" be considered a nonpoint source.

The White River has high metal concentrations. The Missouri River in general has high mercury concentrations.

Point Source Pollution

Increases in energy-related activity are adding to the waste load carried by the Knife River and tributaries.

Removal of lignite aquifers could result in disturbance of ground-water supplies in the Knife and Cannonball River Basins.

Portions of the Cheyenne River and Belle Fourche River have high mercury, arsenic, and cyanide concentrations.

Rural residential developments, road construction, timber industry practices, and livestock wastes are reducing water quality in the Belle Fourche River Basin.

It is expected that increased mining and oil drilling activities could adversely affect both ground water and surface water over large segments of the Missouri River Basin.

Natural Resources

Eutrophication is a problem in most lakes in the Black Hills.

LEGAL AND INSTITUTIONAL FACTORS

Reserved Water Rights

Indian and Federal water rights persist as an issue in the subbasin.

INSTREAM FLOWS

Evaluation of Effects of Changing Streamflows

During dry cycles, irrigation diversions are dewatering many streams, especially the White River.

EASTERN DAKOTAS SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

South Dakota has completed the resource inventory phase of its State water planning activities for all of the subbasin. As presently scheduled, current and future water supply and use will be analyzed; then water resource development alternatives will be formulated.

North Dakota published its State Water Plan in 1968 and a major effort to update and revise the plan is presently underway.

Nebraska published its State Water Plan in 1971 and presently needs to implement a trial period to make its new "State Water Planning and Review Process" operational.

Iowa published its State Water Plan in 1978.

Minnesota is scheduled to publish its State Water Plan in 1979.

Many conflicts between competing, offstream water uses and instream vs. offstream water use need to be resolved in each of the five States through their State water planning processes.

Interstate

The North Dakota State Water Commission has received many water permit applications from persons interested in using water from the James River. But it is unable to determine whether water is available because of inadequate water supply and water use data. A need exists to develop a hydrologic model of the river that would help determine water availability. The South Dakota Department of Water and Natural Resources also lacks water supply and water use data, especially data concerning the impact of water use along the James in North Dakota on water availability in northern South Dakota. At the present time, a useful model cannot be developed because the hydrologic effects of Sand Lake National Wildlife Refuge are unknown.

South Dakota and Iowa need to ensure compatibility of water supply and water use data and to coordinate their flood plain management activities along the Big Sioux River since the river is their border. Nebraska and South Dakota need to ensure data compatibility and to coordinate their activities along the Missouri River because that river is their border.

Federal/State

Lack of ground-water quantity and quality information and an inadequate streamgaging network are problems throughout the subbasin. To a lesser extent, water use, soils, and topographic data need to be collected.

FLOODING

Urban and Built-Up

The slope of the James River is much less than that of its tributaries. On the average, one major flood has occurred along the James River every 15 years. The Jamestown and Pipestem Reservoirs have essentially curtailed major flood damage at Jamestown and downstream to the South Dakota State line, although some local flooding from tributaries occurs in Oakes, North Dakota. Other cities along the James experience minor flooding problems.

The Big Sioux River has caused flooding problems at Brookings, South Dakota, that are compounded by Six Mile Creek runoff; at North Sioux City; at Flandreau, and Trent, South Dakota, where damages occur almost every year; Dell Rapids, South Dakota, with six floods in 25 years; Rock Valley, Iowa, with five

floods in 38 years; and Castlewood, Bruce, Watertown, Dempster, and Estelline, South Dakota.

Mocassin Creek also has caused flooding in Aberdeen, South Dakota.

Rural

Due to high discharge from the Elm River, the James River may flow upstream, spilling into Sand Lake National Wildlife Refuge. Slow drainage caused by silt build-up in small irrigation dams and trapped debris near inadequate bridge and culvert openings result in long periods of flooding in the Lake Plain area in northern South Dakota. Along this reach from Columbia to near Redfield, 30,000 acres are subject to prolonged flooding. Also along the James, 3,000 acres lie in the flood plain between Turtle and Foster Creeks; from Foster Creek to the mouth of the James, 40,500 acres are flooded in a 10-year flood and 46,000 acres in a 100-year flood. James River tributaries of Crow Creek, Elm River, and Turtle Creek can cause flooding on 45,000 acres, 11,500 acres, and 16,800 acres, respectively.

Along the Big Sioux River, 34,800 acres upstream of Sioux Falls and 25,600 acres downstream of Sioux Falls are subject to flooding. Big Sioux River tributaries of Skunk Creek, Split Rock Creek, and Willow Creek also cause rural flooding problems.

Localized rural flooding can occur on many other waterways in the subbasin.

FISH AND WILDLIFE

Wetland Habitat

Farming techniques, especially private irrigation development and cropping of unsuitable land, are causing wetlands to be destroyed throughout the subbasin (2 percent decline in wetlands annually in some portions of North Dakota). This is especially costly in North Dakota and northern South Dakota because the region is very important as a breeding area for migratory waterfowl, especially ducks. Loss of wetlands may also reduce flood storage capability, nutrient retention, and ground water recharge.

Riparian Habitat

Riverine habitat is deteriorating because of increased land use along almost all waterways in the subbasin. This habitat is also declining along shores of many lakes in the subbasin.

Fisheries Habitat

Sediment loading in the James and Big Sioux Rivers, accompanied by increased nutrient levels, is inhibiting fish propagation. Sedimentation in all lakes in Eastern South Dakota is decreasing fish habitat.

Fluctuating water levels in rivers and lakes throughout the subbasin are causing fisheries habitat problems.

Endangered Species

The bald eagle is an endangered species living in the bluffs along the Missouri River.

IRRIGATION

Water Shortage

There is considerable interest in expanding the acres of privately irrigated land because land suitable for irrigation exists in many portions of the subbasin. However, two problems exist: (1) lack of information on how much ground and surface water is available, and (2) where data have been collected, no water of sufficient quantity or quality is available.

Large-scale water diversion opportunities exist at many points along the Missouri River and along some of the other major rivers in the subbasin.

Efficiency

Since water and energy will become increasingly expensive in the future, efficient methods of transmitting water from available sources and delivering the water to the crop will need to be developed and implemented.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Streambed and bank degradation problems exist below the main

WATER QUALITY

Nonpoint Source Pollution

Runoff from agricultural land, especially cropland, with its sediment, fertilizers, herbicides, and pesticides causes almost all the water quality problems in the subbasin. The levels of total solids, nitrogen, and phosphates in most streams and rivers is higher than optimum. This leads to severe euthrophication of many lakes, and reduces the possible uses of the water.

Each State's nonpoint source pollutant management program needs to be reflected in landowner's farming practices. Inadequate Federal, State, and local funds have been appropriated to implement this program.

Point Source Pollution

Point source pollution is generally controlled, and the problem is localized. Presently in North Dakota, there are 12 point sources of pollution: eight municipal sewage disposal facilities, one sand and gravel pit, one private sewage disposal system, and one private water treatment plant. In South Dakota, half of the point sources present pollution problems.

Natural Sources

Most ground water quality problems are caused by natural factors. Ground water quality ranges from good to very poor. Most rural supplies come from ground water and most of the water does not meet the Safe Drinking Water Standards.

Natural contamination of surface water is caused by nitrates and dissolved and suspended sediment.

LEGAL AND INSTITUTIONAL

Legal Definition of Ground/Surface Water Relationships

Nebraska does not have a legal basis for relating ground water pumping to surface water depletion.

Legal Definition of Beneficial Uses of Water

None of the five States in this subbasin recognize water used for hydropower production as a beneficial water use. Nebraska does not recognize fish propagation and assimilation of water pollutants as a beneficial instream use of water.

Institutional Conflicts

The Fish and Wildlife Service and the State of North Dakota disagree on the implementation of the Service's Small Wetlands Acquisition Program. The Water and Power Resources Service is deferring acquisition of fish and wildlife mitigation for the Garrison Diversion Project until the above stated disagreement between North Dakota and Fish and Wildlife Service is settled.

Communication among State, Federal, and local water resources organizations needs to be improved, especially in the James River Basin area.

INSTREAM FLOWS

Evaluation of Effects of Changing Streamflows

Information on the impacts of differing levels of flow needs to be compiled for all major rivers in the subbasin. There will be impacts to instream water users if flow is reduced and impacts to offstream water users if flow is not allowed to drop below a specified level.

Determination of Streamflow Requirements

The water requirements of instream water uses need to be determined for all major rivers in the subbasin. In Nebraska, North Dakota, and South Dakota, streamflows are not effectively protected.

WEATHER MODIFICATON

Precipitation Shortages

Growing season rainfall is extremely variable in the subbasin. In 30 to 40 percent of the years, rainfall is less than 85 percent of the long-term average.

PLATTE-NIOBRARA SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

The State of Colorado is in need of accelerated funding for

WATER QUALITY

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PLATTE-NIOBRARA SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

The State of Colorado is in need of accelerated funding for

the cooperative development of the third phase of its State Water Plan with the Water and Power Resources Service.

Nebraska needs to implement a trial period to make its new State Water Planning and Review Process operational; to work out the procedural details; assess its strengths and weaknesses; and develop plans, information, and reports.

The Wyoming State Water Plan contains some out-of-date information and is in need of updating.

The USGS/State cooperative water-use information system needs to be expanded throughout the basin.

Collection of ground-water data needs to be expanded and accelerated in the western portion of the subbasin.

FLOODING

Urban and Built-Up

Severe and recurring urban flooding occurs at communities having flood-plain areas adjoining the basin's major streams and tributaries. These include but are not limited to: the South Platte River and tribs along Colorado's front range; the North Platte River from Casper, Wyoming, to Glendo Reservoir; the lower Loup River Basin near Columbus, Nebraska; the middle and lower Platte River in Nebraska; and the lower Elkhorn River Basin in Nebraska.

Ice jams aggravate spring flooding upstream from the confluence of the Platte and Elkhorn Rivers, particularly at Valley and North Bend, Nebraska.

Rural

Flash floods caused by summer thunderstorms occasionally flood agricultural lands on the eastern plains in Wyoming and Colorado and often damage irrigation systems.

North Platte tributaries in Wyoming and Nebraska are subject to frequent spring floods, damaging rural lands, communities, farmsteads, and utilities.

The Platte River channel has accumulated brush and tree growth in central Nebraska due to diminished annual discharge, causing overbank flooding during periods of high runoff.

The South Platte River in Colorado and into Nebraska floods adjoining agricultural lands during spring runoff, and when tributaries rapidly carry excess flows to the river.

Agricultural lands, roads, and utilities are subject to occasional severe flooding along the Platte River and its major tributaries in central and eastern Nebraska.

FISH AND WILDLIFE

Wetland Habitat

Wetland drainage in Nebraska's Rainwater Basin has in the past adversely affected waterfowl habitat. In the middle Platte area, drainage of wetlands has reduced wetland acreage, but is partially offset by return flows from surface irrigation systems.

Declining water tables also have negative effects on the occurrence and quality of wetland wildlife habitat.

Riparian Habitat

Changes in stream regimen caused by upstream depletions and reservoir operations may have affected critical waterfowl habitat along the central Platte River Valley in Nebraska. Portions of the area have been designated as "critical habitat" for endangered species by the Secretary of the Interior.

Fisheries Habitat

The annual "silt run," whereby silt-laden water is flushed out of Guernsey Reservoir into irrigation canals in Wyoming and Nebraska in order to seal leaks, may adversely affect fisheries habitat in the North Platte River.

Periodic low flows caused by extended droughts, sub-normal snowpack, land conservation measures, and/or depletions adversely affect subbasin fisheries.

Endangered Species

Conflicts involving water and land use exist in some portions of the Platte River at certain times in areas designated as "critical habitat" for the endangered whooping crane.

IRRIGATION

Water Shortages (Ground, Surface)

Certain areas in the central Platte Valley in Nebraska, an area of highly concentrated irrigated agriculture, are suffering declines in ground-water levels due to irrigation pumping.

Ground-water reserves throughout the High Plains/Ogallala area are declining due to pumping for irrigation. Severe economic stress is projected as water supplies dwindle and pumping costs increase.

Surface water shortages regularly occur along the South Platte and tributaries in Colorado, Wyoming, and Nebraska. Additional storage and improved management to reduce seasonal and annual shortages is required.

The Mirage Flats project in northwestern Nebraska is chronically short of surface water to meet demands.

The Box Butte area and aquifers underlying portions of the lower Niobrara drainage in Nebraska have declining ground-water tables due to irrigation pumping.

Opportunities exist for irrigating additional lands in the Loup Basin, upper Elkhorn Basin, and areas on the high plains separating the North and South Platte Rivers, but water availability and cost may present problems.

Efficiency (Water, Energy)

A number of irrigation systems along the North Platte and South Platte Rivers and tributaries in Wyoming and Nebraska are in need of rehabilitation and betterment. It should be noted, however,that some junior appropriators and wetland habitat are dependent on the return flows and seep from canals upstream.

Opportunity for improved in-field management to upgrade water efficiency exists in many areas of the subbasin.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Severe bank erosion occurs along several reaches of the Elkhorn River and tribs in eastern Nebraska; bank sloughing diminishes agricultural production and threatens roads, farmsteads, and utilities. Bank erosion is also a problem on other small tributaries to the lower Platte River.

Upland Soil Erosion

The Ponca Creek drainage in Nebraska and South Dakota is subject to severe gully erosion.

The Sand Hills in Nebraska are vulnerable to wind erosion, causing blowouts when the fragile, thin top soil is disturbed. Encroachment of irrigated agriculture is a threat to these thin soils.

Sheet erosion is a problem in steeper tributary drainage in the South Platte Basin.

Sediment Deposition

Sediment is a problem in storage structures in the Loup River Basin due to the heavy stream load.

Drainage

High ground-water tables due to irrigation system leakage, deep percolation, and return flows cause waterlogging, lowland flooding and drainage problems in portions of the central Platte Valley and Farwell area in the Loup Basin.

Seepage from canals and return flows are a problem on Wyoming's Kendrick Project.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC SUPPLY

Municipal

Provision of municipal supplies for the "front-range" area in Colorado, including Denver is a problem. In-basin supplies are limited, and further transbasin diversions are becoming more difficult to implement.

Cheyenne, Wyoming's municipal supply is dependent upon transbasin diversions from the Colorado River Basin. Provision of additional supplies faces potential institutional conflicts.

Rural Domestic

Rural water supply is inadequate in certain areas in Colorado's South Platte River Basin, the eastern end of Nebraska's Platte and portions of the Niobrara River Basins, and in eastern Wyoming. Major problems are unreliable ground-water supplies and poor quality.

Nitrate concentrations are a problem for users of sub-surface water supplies in portions of the central Platte and Niobrara basins in Nebraska.

Industrial

Projected additional coal production in the North Platte Basin in Wyoming will strain existing water supplies and may conflict with agricultural and other water users.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

Streams designated for study as components of the national system of wild and scenic rivers in Nebraska, Colorado, and Wyoming, including the Niobrara, Sweetwater, Encampment, North Platte, Big Thompson, and Cache le Poudre, need to be investigated. Conflicts with other users may develop in certain areas.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

Reservoir operations at Glendo and Guernsey Reservoirs on the North Platte in Wyoming occasionally adversely affect recreational use.

Public power and irrigation district reservoirs in central Nebraska sometimes are drawn down to levels adversely affecting recreational use.

Some reservoir pools on South Platte tribs are dedicated to power supply or irrigation and are subject to fluctuating levels during the recreation season.

Water Access

Public access to trout streams in the North Platte and Niobrara Basins in Nebraska is very limited.

Private reservoirs on the Colorado eastern plains lack recreation access or facilities.

Lack of Facilities

Eastern Nebraska's densely populated areas are deficient in water-based recreation. Development of the lower Platte, Missouri, and Elkhorn Rivers' recreation potential is needed.

Front range area residents in Colorado have a shortage of water-based recreation.

TRANSPORTATION

Slurry Pipelines

Water proposed for use in a coal slurry pipeline originating in Wyoming conflicts with other existing or proposed uses.

WATER QUALITY

Nonpoint Source Pollution

Nebraska's Salt Creek carries excessive concentrations of organic pollutants and dissolved solids. Inorganic pollutants resulting from a number of industries in the area have also found their way into Salt Creek. Major problems are municipal and industrial outflows at Lincoln and occurrence of natural salts.

South Platte River water quality in Colorado is degraded due to irrigation return flows and natural salt pick-up.

The North Platte River below Casper, Wyoming, carries excessive TDS and TSS concentrations.

LEGAL AND INSTITUTIONAL FACTORS

Water Allocation

Opportunities for further development of North Platte River

water in Wyoming for irrigation or energy use is restricted by Supreme Court Decree.

Legal Definition of Ground/Surface Relationships

Opportunity for improved management of existing surface- and ground-water supplies exists in Nebraska if ground- and surface-water relationships were better defined.

Interbasin Water Transfer

Potential conflicts involving the transfer of water from one basin to another exist for the following areas:

a. Platte River to Little Blue River, Nebraska - proposed diversion of surplus spring flows to be stored in Little Blue Basin for irrigation use;

b. Colorado River to South Platte River, Colorado - transmountain diversions for water supply for Front Range communities face institutional conflicts; and

c. Little Snake River (Colorado Basin) to North Platte River, Wyoming - increasing transmountain diversion for Cheyenne municipal supply faces institutional conflicts.

Legal Definition of Beneficial Uses of Water

Instream uses of water for habitat and/or recreation are currently not recognized in Nebraska and Wyoming.

Reserved Water Rights

Indian and Federal reserved water rights need definition throughout the subbasin in order to plan for future water management.

INSTREAM FLOWS

Determination of Streamflow Requirements

Requirements for fish and waterfowl using the Platte River and Niobrara River in Nebraska need to be determined.

WEATHER MODIFICATION

Precipitation Shortages

Additional applied research is needed to determine how to augment snowpack and water supply in Colorado's and Wyoming's mountain areas.

Hail Damages

Hail damage is a serious problem in extreme southwestern Nebraska, southeastern Wyoming, and northeastern Colorado, causing extensive crop and property damage.

MIDDLE MISSOURI

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

Nebraska needs a trial period to make its new State water planning and review process operational; to work out procedural details; assess its strengths and weaknesses; and develop plans, information, and reports.

Federal/State

States need support for a broad base of data collection activities including more streamgaging stations, additional funding, and State involvement in cooperative programs.

Funds should be provided to States that are required to assist Federal activities such as fish and wildlife, recreation, natural historic, and cultural programs.

FLOODING

Urban and Built-Up

Flooding is still a problem along many of the tributary streams in the Middle Missouri subbasin. One of the more critical areas in the subbasin is the area in Sioux City affected by flooding from Perry Creek. Other communities have experienced flooding over the years and flood insurance studies will identify communities which may have flood threats in the Middle Missouri subbasin. There may be some structural solutions to the flooding threat in some of the communities that will be identified in appropriate flood control studies.

Rural

Rural flood damages, including crop and pasture, other agricultural, and other rural damages, range from minor to severe in small watersheds in the southeastern part of Nebraska. Some watersheds in the northeastern part also suffer severe damages.

Missouri River flood damages along most of the reach of the Missouri River downstream of the Platte River in Nebraska continue to be a problem even though levees have been constructed. The reach around Nebraska City, Nebraska, appears to be a major problem area. Flooding becomes more widespread further downstream. Levees in the lower reaches are predominantly private and are being moved or constructed too close to the river. Aggradation of the stream bed in some reaches is also another factor that is affecting the flooding problem.

Missouri River tie-back levees are designed to provide protection from large floods. In most cases, the protection is greater than that needed from a 100-year flood. The tie-back levees on the tributary streams (in the reaches of the river with levees) were designed to provide protection from flooding caused by main stem and tributary flooding. The design level of protection from the tributary floods was set at the 50-year level. Due to numerous factors, including aggradation of the tributary stream beds, this level of protection has been reduced to more frequent flooding occurring from 10-years to 25-years.

FISH AND WILDLIFE

Wetland Habitat

There is a net loss of water surface area due to the loss of wetlands not being replaced by maturing wetlands.

Riparian Habitat

The transition of existing uses with the conversion of woodlands to agricultural use has effected riparian habitat.

Fisheries Habitat

Oxbow elimination and channel straightening have reduced and changed fishery habitat.

Endangered Species

The bald eagle is an endangered species in this subbasin.

IRRIGATION

Water Shortage (Ground; Surface)

There is a shortage of water in northwest Iowa. In the Cass-Otoe County areas of Nebraska water shortage has been identified by a Water and Power Resources Service study.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

The statewide 208 plan identified the second largest problem in Nebraska as being erosion in the Nemaha Basin. Other erosion problems occur in the Nishnabotna and Nodaway Basins in Iowa and Missouri.

Upland Soil Erosion

Steep slopes and soil types cause upland soil erosion especially in northwestern Missouri and northwestern Iowa.

The Missouri Water Quality Management Plan prepared in 1979 identified gully erosion in northwestern Missouri as a severe to very severe problem in the Middle Missouri subbasin portion of the State. These two classifications indicate that gully erosion is in the range of 200 to 499 tons per square mile (severe) or 500 to 750 tons per square mile (very severe). The Nebraska counties in the area between Omaha and South Sioux City have the highest soil loss rate from the sloping uplands in the State. Iowa counties bordering the Missouri experience similar erosion problems.

Land Use Changes

Conversion from agriculture to urban or other developed uses increase the problems associated with the land. First, stripping of top soils and removal of trees occurs; the changing drainage then causes serious erosion; when the development is staged over a period of time the full realization of the immediate and continuing effects are not evident.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

There is a lack of dam sites or storage areas for municipal facilities in various parts of this subbasin.

Rural Domestic

Water quality problems occur in Otoe and Cass Counties, Nebraska, and in the Sioux City area and southwest Iowa. Better planning and coordination are needed for rural domestic systems between service areas. In Nebraska, rural domestic systems are designed either to meet existing users with no provision for expansion or too large to be economical with the result that users leave the system.

Industrial

Small water districts cannot accommodate industrial users.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

The Loess Bluffs area should be clearly identified and related to the other historical site preservation work such as Lewis & Clark Trail, the Mormon Trail, and other related cultural projects with the river resource.

POWER AND ENERGY

Power Plant Cooling

The maximum energy potential from water use by low head hydropower should be realized in this subbasin. Power plants should be located on a major river for assimilation of cooling water. Thermal pollution is a problem on smaller streams.

Disposal of power plant cooling into smaller bodies of water such as Browns Lake where thermal pollution can be controlled could be considered opportunity in the production of fish.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Access, Lack of Facilities

There is a documented demand for water access and facilities in metropolitan areas such as Sioux City and Council Bluffs as well as in southwestern Iowa.

TRANSPORTATION

Navigation

The opportunity exists for port facilities in the Council Bluffs area to make increased use of transportation on the Missouri River.

WATER QUALITY

Nonpoint Source Pollution

Urban runoff in the metropolitan areas is a major source of nonpoint source pollution.

Herbicides, pesticides, and fertilizers are nonpoint sources of pollution in rural areas.

Feedlot operations need enforcement in Iowa to prevent organic material from getting into the water system.

Natural Sources

The Missouri River is noted for turbidity and high levels of suspended solids.

LEGAL AND INSTITUTIONAL FACTORS

Legal Definition of Ground/Surface Water Relationships

Important questions in Nebraska law and policy to be addressed in planning include additional ground water management policies and the allocation and management of competing uses of ground water and surface water, as well as long-term and short-term augmentation from available supplies of surface and ground water.

In Iowa, stream use for recreation purposes needs clarification--definition of access by boat and foot should be

recognized by law. Land ownership near State perimeters need clarification by State boundary commissions. Identification of State-owned lands (oxbow lakes) in Iowa is a legal problem for enforcement.

Interbasin Water Transfer

Great concern is expressed that upstream diversions will affect all downstream uses and decrease navigation.

Possibility of State compacts may be required.

INSTREAM FLOWS

Evaluation of Effects of Changing Streamflows

The season variation of flow affects stream water quality on those with waste water treatment outfalls.

States in this subbasin are not uniform in recognizing instream uses. As a result there is a lack of uniformity between States for streamflow requirements in the establishment of standards for fish and wildlife on a stream-by-stream basis.

Consumptive use and diversions by upstream States decrease the amount of water available for downstream users.

KANSAS SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

The State of Colorado is in need of accelerated funding for the cooperative development of the third phase of its State Water Plan with the Water and Power Resources Service.

Nebraska needs a trial period to make its new State Water Planning and Review Process operational; to work out the procedural details; assess its strengths and weaknesses; and develop plans, information and reports.

The Kansas State Water Plan contains some dated information.

Opportunity exists for a regional comprehensive water plan for the subbasin to tie together the many recommendation contained in agencies' ongoing and completed studies.

The USGS/State cooperative water-use information system needs to be expanded throughout the basin.

FLOODING

Urban and Built-Up

Severe and recurring urban flooding occurs at communities having flood-plain areas adjoining the Big Blue and Little Blue Rivers and their tributaries.

Rural

Rural flooding occurs on streamside lands throughout the subbasin; particularly the major tributaries. Clogged channels and sediment deposits aggrevate the problem in the Big and Little Blue basins.

Encroachment of riparian vegetation as a result of reservoir operations and irrigation diversions on the Republican River below Harlan County Reservoir diminish channel capacity, contributing to overbank flooding.

FISH AND WILDLIFE

Wetland Habitat

Drainage of wetland acreage necessary for waterfowl habitat is a serious problem in the upper reaches of the Big Blue, Little Blue and Republican River basins, in the area known as the Rainwater Basin.

Fisheries Habitat

Reservoir operations at Harlan County reservoir on the Republican River can have negative effects on fish propagation in the lake and fish habitat downstream.

Ground-water pumping by irrigators in the upper Republican and Frenchman River basins in southwestern Nebraska and northeastern Colorado reduces base flows for instream habitat.

IRRIGATION

Water Shortage (Ground, Surface)

Pumping by irrigators using privately operated ground-water systems in the upper Republican basin in Nebraska reduce water supplies available to Federal reservoirs needed for local irrigation districts.

Ground-water pumping for irrigation in the Big Blue and Little Blue basins in Nebraska is rapidly dropping water tables throughout the area, notably in Adams, Clay, Fillmore, York, and Hamilton Counties.

Ground-water reserves throughout the High Plains/Ogallala area are declining due to pumping for irrigation. Severe economic stress is projected as water supplies dwindle and pumping costs increase.

Lands suitable for irrigation in the upper Little Blue and Republican basins in Nebraska are without a source of water. Opportunities for storage and/or transbasin diversion need further investigation.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Severe bank erosion occurs along several reaches of the Kansas River; bank sluffing diminishes agricultural production and threatens roads, farmsteads, and utilities.

Upland Soil Erosion

Soil losses due to sheet erosion are most severe in the northeastern portion of the subbasin, where precipitation is greatest.

Wind erosion is a problem on the high plains in western Kansas, southwestern Nebraska, and eastern Colorado.

Gully erosion is a problem in the tributary drainage to the Republican and Kansas Rivers.

Sediment Deposition

Sediment adversely affects water quality in the Big Blue and Little Blue Basins above Tuttle Creek Reservoir.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC SUPPLY

Municipal

Periodic low flows aggravate saline concentrations and impair the quality of municipal supplies along the Kansas River at Manhattan, Topeka, and Lawrence.

Rural Domestic

Rural water supply is inadequate in many areas in the 3-State basin due to poor quality of ground-water supplies or inadequate distribution systems.

NATURAL, HISTORIC, AND CULTURAL RESOURCES

Natural Area Preservation

River reaches in Kansas and Nebraska need studies in order to quantify their values for recreation and other nonconsumptive uses.

Wetlands necessary for waterfowl propagation in the upper Big Blue, Little Blue, and Republican basins are threatened with drainage for agricultural production.

Historic Site Preservation

Archeological sites at Federal reservoirs in Kansas need protection.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

Water level fluctuations at Harlan County Reservoir have adverse effects on boating, swimming, fishing, and other recreational pursuits.

Water Access

Public access for recreation is limited on many stream reaches in the basin.

Lack of Facilities

Serious deficiencies of water-based recreation opportunities exist in the Big and Little Blue Basins in Nebraska and in Kansas' upper Republican and Solomon Basins.

WATER QUALITY

Nonpoint Source Pollution

Quality of many of the basin's streams is degraded during recurring low-flow periods. Dissolved solids and organic pollutant concentrations are a problem due to irrigation return flows and overland runoff.

Point Source Pollution

Outflows from municipalities and industries with below-standard treatment throughout the basin contribute to water quality problems.

Natural Sources

Naturally occurring mineral intrusion is a continuing problem in the Kansas River, raising saline concentrations and limiting some uses.

LEGAL AND INSTITUTIONAL FACTORS

Water Allocation

In Kansas, water stored in Federal reservoirs may need to be reallocated in order to fulfill municipal demands.

Legal Definition of Ground/Surface Relationships

Important questions in Nebraska law and policy to be addressed in planning include additional ground water management policies and the allocation and management of competing uses of ground water and surface water, as well as long-term and short-term augmentation from available supplies of surface and ground water.

Legal Definition of Beneficial Uses of Water

Instream uses of water for habitat and/or recreation are currently not recognized in Nebraska and Kansas.

Reserved Water Rights

Indian and Federal reserved water rights need definition throughout the subbasin in order to plan for future water management.

Institutional Conflicts

In Kansas, local and State policies conflict with rules and regulations of the Farmers Home Administration regarding rural systems development, often stifling progress.

INSTREAM FLOWS

Determination of Streamflow Requirements

Requirements for waterfowl and fisheries need to be determined on the basin's water courses.

WEATHER MODIFICATION

Precipitation Shortages

Additional applied research and application by State and local entities needs to be conducted to augment precipitation in the arid high plains area during the growing season.

Hail Damages

Reduction of crop damage from hail storms needs continued research in central and western Kansas and eastern Colorado.

LOWER MISSOURI SUBBASIN

COMPREHENSIVE PLANNING AND SUPPORT ACTIVITIES

State

Increased pressure on land and water resources in this subbasin has led the States to prepare water plans that will result in a coordinated regional planning effort. Each State should complete its State water plan.

Federal/State

Iowa needs continued support for its water and related land resources data collection activities. The subbasin lacks a good land use data base. Water use information for all needs should be a continuing effort. There is a need for more data on instream water use.

FLOODING

Urban and Built-Up

Problems with urban stormwater runoff and flooding occur in the four subbasin SMSA's and is especially noticeable along flood plains on many streams that flow through developed areas: Kansas City, Columbia-Jefferson City, Springfield, and St. Louis.

Rural

The Grand River Basin has significant flood problems and recurring flooding is serious to crops and improvements in the flood plains; annual flooding in the Grand River Basin involves some 370,000 acres, 80 percent of which is agricultural in nature. Flooding also occurs in the Chariton, Marais des Cygnes, Osage, and Fishing River Basins.

Third class counties in Missouri must adopt county wide planning and zoning in order to participate in the Federal flood insurance program. Few counties can obtain public support needed to pass local referendums.

FISH AND WILDLIFE

Wetland Habitat

Wetlands and forest lands are declining in the flood plains. Wetlands have been converted to agricultural or urban uses.

Riparian Habitat

On the Missouri River, channel improvements have reduced backwater areas, islands, and sandbars. Elsewhere on tributaries such as the Grand, South Grand, Chariton, and Blackwater channel straightening has reduced riparian habitat.

Fisheries Habitat

Missouri River channel modifications and bank stabilization activities have reduced fisheries habitat.

IRRIGATION

Water Shortage (Ground, Surface)

Additional research is needed on irrigation in this basin.

LAND CONSERVATION AND MANAGEMENT

Streambank Erosion

Stream systems in north- and west-central Missouri and southern Iowa are unstable with increased bed load and active bank erosion, particularly in channelized stretches.

Upland Soil Erosion

Erosion of upland soils is a major problem in the northern half of the subbasin. The soils in South Grand, Blackwater, Grand and Chariton basins are primarily of loess or loess over glacial till. These soils are productive cropland and are often tilled. Due to the rolling topography, annual soil loss on unprotected tilled cropland often exceeds 25 tons per acre. This loss is five times the rate of allowable loss to maintain sustained crop production and also is a major contribution to nonpoint water pollution.

Sediment Deposition

Heavy sediment loads have occurred on tributaries such as the Grand, South Grand, and Chariton primarily as the result of mismanagement of land resources.

MUNICIPAL, INDUSTRIAL, AND RURAL DOMESTIC WATER SUPPLY

Municipal

In order to supply local municipalities, combined rural water supply districts are needed in north- and west-central Missouri to provide dependable supplies; either ground water, large stream or surface storage is required.

Federal Governmental procedures prohibit rural domestic water supply systems from being designed for expansion in growth areas; regional solutions are needed for more efficient county water systems.

Reallocation of uses from Federal reservoirs may be necessary to meet new water requirements.

Industrial

Local ground water of unacceptable quality occurs in north- and west-central Missouri.

NATURAL, HISTORIC, AND CULTURAL

Opportunities exist to integrate projects such as Lewis and Clark trails and other trails into water oriented recreation activities in the subbasin.

POWER AND ENERGY

Hydroelectric Power Production

Opportunities exist in this subbasin to meet national and regional power demands for additional power generation at existing projects or potential sites.

Power Plant Cooling

Future plants would require large quantities of cooling water. At times of low flow in the Missouri River, the Labadie power plant water cooling operations affects the water levels for recreation at the Lake of the Ozarks.

Coal Gasification

Coal gasification is possible in the Grand River Basin in north central Missouri if water supplies are sufficient and along the Missouri River in central Missouri. High sulphur coal is contained in this area. Additional opportunities exist for by-products resulting from conversion of coal to gas.

Tar sands in Bates, Vermon and Barton counties possess potential for energy production, but water demand for processing is presently unknown.

WATER-ASSOCIATED OUTDOOR RECREATION

Water Level Fluctuations

The opportunity exist to examine and monitor the effects of reservoir operations at Harry S. Truman Dam.

Water Access

Access to water-oriented recreation is limited along many streams in this subabsin and especially along the Missouri River and in the Marais des Cygnes Basin.

Lack of Facilities

Present Federal laws conflict with State laws regarding State's ability to repay its portion of recreation facilities at Federal projects over time. A similar problem exists for the operation and maintenance costs for which the State is responsible.

TRANSPORTATION

Navigation

During water short periods, increasing upstream depletions may shorten the navigation season on the Missouri River.

WATER QUALITY

Nonpoint Source Pollution

Agricultural runoff has affected water quality in the subbasin. There is an opportunity to alleviate this problem through implementation of Best Management Practices (BMP) listed in State water quality management plans. Periodic monitoring, evaluation, and refinement of the recommended practices are part of the plan.

Mine drainage including suspended solids and acid wastes were responsible for pollution on such streams as Locust Creek; lower east fork of the Chariton River and the Chariton River in Putnam, Schuyler, Sullivan and Adair counties. A major problem occurred on the east fork of the Chariton River with acid-mine drainage in the Macon-Randolph area. In the Henry and St. Clair county and the Boone-Callaway county areas, acid water from abandoned strip mines are a problem. Inactive orphaned strip mines developed prior to 1973 are not covered by State reclamation laws.

Treatment of sanitary wastes by use of individual septic tanks in areas that experience rapid growth, recreation and urban sprawl areas, can and has increased the difficulty of long-term comprehensive management of ground- and surface-water quality.

Point Source Pollution

The opportunity exists to attain stream standards with completion of waste treatment facilities through 201 programs. Sewage overflows and stormwater drainage occur in some cities including St. Louis and Kansas City SMSA's that periodically cause point source pollution.

Natural Sources

The opportunity exists to determine how natural sources affect land use in north- and west-central Missouri.

LEGAL AND INSTITUTIONAL FACTORS

States

There is a problem of reallocating water storage on Federal reservoirs to meet new and expanding needs of industrial and rural domestic users.

The opportunity exists for a planned river corridor on the Lower Missouri River to implement and enforce planned development and flood management.

Interbasin Water Transfer

Future diversions to other basins concern Missouri for navigational flows and for other water purposes.

INSTREAM FLOWS

Determination of Streamflow Requirements

Quantity of water available in the Missouri River for instream uses such as navigation, fish and wildlife, waste assimilation, and downstream area energy use depends on water utilized in upstream States. Interstate ageements on water rights may be required on the Missouri River.

Evaluation of Effects of Changing Streamflow

Programs that result in modification of the streamflows influence other programs that make decisions based on flow. Modification of low-flow statistics are normally the most significant in terms of program conflicts.

Opportunities exist for coordination and planning of water quality/quantity for all uses. Water conservation programs should be an important part of the solution to this problem.

APPENDIX E – REGIONAL PRIORITIES

APPENDIX E

REGIONAL PRIORITIES

BACKGROUND

An integral part of the Missouri River Basin Commission's comprehensive planning process is the annual setting of priorities for initiation of important water resources projects and programs. Priorities are established for Federal and federally assisted activities from among the hundreds of projects and programs contained in the Commission's approved regional plan.

Development of priorities for water resources activities is one of four specific congressional directives cited in river basin commissions' governing legislation, the Water Resources Planning Act of 1965. Section 201 of the Act states in part that river basin commissions shall "recommend long-range schedules of priorities for the collection and analysis of basic data and for investigation, planning, and construction of projects...." The Federal "Principles and Standards" support this mandate by further declaring that State and Federal members of river basin commissions have a responsibility to participate in the setting of priorities.

The purpose of annually establishing regional priorities is to provide guidance to the President, Congress, State legislatures, and Federal, State, and local agencies during the scheduling, funding, and conduct of such activities within the basin.

Priorities for the immediately upcoming fiscal year are directed at obtaining congressional authorization and funding of urgently needed programs within the basin.

Regional priorities for the subsequent fiscal year are developed primarily to provide guidance for advanced planning, programming, and budgeting by Federal, State, and other agencies.

The Commission has conducted an annual priorities process since 1974. During the subsequent years, the Commission's standing Priorities Committee has considered hundreds of proposals submitted by the State members and has annually forwarded its recommendations for regional priorities to the Commission. With few exceptions, the Commission has endorsed the committee's annual priority recommendations and published them for the use of decisionmakers and others involved in the field of water and related land resources.

Use of the Commission's regional priorities has increased each year since inception of the process. Many of the priorities recommended in past years' reports have advanced toward or through implementation, partially as a result of their endorsement as a regional priority by the Missouri River Basin Commission.

THE ANNUAL PROCESS

The MRBC priorities process begins in May when the Priorities Committee sets the specific criteria and procedures in accordance with the general guidelines contained in Commission Policy Statement C, "Establishment of Annual Priorities for Water and Related Land Programs." The Commission chairman in mid-May requests the 10 State members to submit, within 60 days, their respective State priority proposals for the second subsequent fiscal year.

After they are submitted, the State proposals are compiled by Commission staff and forwarded to the Priorities Committee for individual review and evaluation. Each Committee member rates each and every proposal on the basis of five criteria. Criteria used by committee members in evaluating State proposals include:

- o economic effects;
- o environmental effects;
- o interstate/regional implications;
- o compatibility with other programs; and
- o probability of implementing the proposal.

Another criterion which weighs heavily in the rating process is the priority assigned to the proposals by the State. Inclusion of this criterion enhances the priority rating for proposals submitted by more than one State.

The Priorities Committee meets in September to assemble its recommended listings of regional priorities. Its recommendations are then forwarded to Commission members for their review. The final regional priorities are adopted by MRBC at its November quarterly meeting.

In early January, the Commission Chairman transmits copies of the final report to Commission members, the Water Resources Council, to congressional delegations of member States, to heads of Federal agencies, to the 10 basin State Governors, and to key committee members in the U.S. Congress and the State legislatures.

To promote authorization and funding for the high priority projects and progams, the Chairman and Vice Chairman annually conduct a follow-up to the priorities. Follow-up to the next year's priorities is directed at the Congress during its deliberations on the upcoming year's budget. The Federal Administration is the target of the follow-up to the Commission's adopted priorities for the second subsequent fiscal year.

THE PRIORITIES REPORT

The annual Priorities Report presents the region's priorities for water resources activities for the subsequent two fiscal years. Regional priorities are organized into six categories:

- o Implementation;
- o Feasibility Studies;
- o River Basin Planning;
- o Special Studies;
- o Planning-Related Research; and
- o Data Collection and Analysis.

The regional priorities consist only of Federal and federally assisted activities. With the exception of certain continuing data collection activities, the priorities are limited to new starts, modifications of ongoing programs, or resumptions of discontinued activities. Ongoing projects and programs are not considered.

The Commission's regional priorities for water related programs for each fiscal year are available on request.

APPENDIX F – OFFICIAL COMMENTS ON THE PLAN

APPENDIX F

OFFICIAL COMMENTS ON THE PLAN

ROBERT D. RAY
GOVERNOR

Office of the Governor

STATE CAPITOL
DES MOINES, IOWA 50319

July 16, 1980

ELMER (DUTCH) VERMEER
ADMINISTRATIVE ASSISTANT

Mr. Millard Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Governor Ray has asked that I respond to your recent letter to our office.

The appropriate state agencies have reviewed the Missouri River Basin Management Plan and separate appendices G and H, and Iowa has no objections to the documents.

Thank you for writing Governor Ray.

Sincerely,

Elmer H. Vermeer
Administrative Assistant

EV/jal

STATE OF KANSAS

OFFICE OF THE GOVERNOR
State Capitol
Topeka 66612

John Carlin, Governor

August 27, 1980

Dr. M. W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

Reference is made to your communication of May 30, 1980, transmitting a report of the Missouri Basin Water Resources Management Plan for state review. The Kansas Water Resources Board, designated representative to the Missouri River Basin Commission and Comprehensive Planning Committee, advises that the report is basically an update of the Comprehensive Coordinated Joint Plan prepared in 1977. The report is prepared in response to directives of the Water Resources Council and provides pertinent information on water resources programs of concern to local, state and regional interests. The Kansas Water Resources Board notes that the report can also provide pertinent information and guidance to Congress and the Administration in the formulation of a national resource program. To this extent, the Board endorses and supports the planning document. However, the Water Resources Board advises that in previous years, the Water Resources Council, while approving the plan, has not forwarded the comprehensive plans to the President and the Congress, thus, denying them the basic data and information to evaluate and consider necessary water resources development programs. The Board expresses the view that Commission activities can be more efficiently utilized in other endeavors and any further attempts in the development of a comprehensive basin plan should be deferred unless satisfactory assurances are furnished by the Council that the basic purposes of the planning procedures are fulfilled.

I have visited with the Water Resources Board regarding their views and attitudes concerning the Missouri River Basin Comprehensive Plan. I fully support their views regarding this document

and feel that the plan can provide guidelines to local, state and regional interests of the basin in the development of the water resources. I would urge the Water Resources Council initiate appropriate action at an early date on the comprehensive planning document in order that it may be made available to the Congress through the President for their consideration and information. I would further urge that this review and transmittal be accomplished as expeditiously as possible in order to assure the proper development of this valuable resource.

Sincerely,

JOHN CARLIN
Governor

JC:DCS:ko
cc: Francine Neubauer
Executive Director, KWRB

EXECUTIVE OFFICE
STATE OF MISSOURI
JEFFERSON CITY

JOSEPH P. TEASDALE
GOVERNOR

September 10, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

This is in answer to your request for comments on the Missouri River Basin Water Resources Management Plan, May, 1980. Requested comments on this Plan's Draft Environmental Impact Statement will be forwarded to you separately.

We were very pleased to have had the opportunity to review the Commission's comprehensive plan and found much within the report which is consistent with Missouri's policy goals, in addition to being of vital concern to all states in the Missouri River Basin.

The plan is important in that it describes some 550 water resources programs and projects in the ten river basin states. Because of the number, and sometimes the complexity of these plan elements, my approval of this river basin plan can not be taken as blanket endorsement of all proposals within the report. The regular economic evaluations and environmental appraisals are still necessary, site by site.

Further, Missouri's position as the last state downstream means that we continue to urge completion of the study of current depletion of Missouri River flows. Until better information is at hand, plan statements about the effects of increased water consumption are a speculation which we can not accept as truth.

Thank you for the opportunity to review.

Sincerely,

Joseph P. Teasdale
GOVERNOR

CHARLES THONE
GOVERNOR

STATE OF NEBRASKA

LINCOLN 68509
August 29, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

The Nebraska Interagency Water Coordinating Committee has reviewed the Missouri River Basin Water Resources Management Plan, dated May 1980, and the separate Appendices G and H. We feel the plan is a very positive water and related land resources management plan for the Missouri River Basin and will provide a reliable guide for future programming and budgeting. Our Nebraska agencies appreciated participating in the planning effort and feel that collective judgment has helped to produce an excellent product.

There are a few suggestions on behalf of the State of Nebraska that need to be outlined. They are as follows:

1) Table 2-5 on page 2-29 incorrectly describes the general principles of the South Platte River Compact. The Compact actually provides for administration of water appropriators for the two states in a section of the South Platte River between Balzac, Colorado, to include Nebraska's Western Canal. No apportionment of the water supply of the stream or provisions for state-line flows are identified in the 1923 South Platte River Compact.

2) In reference to the third paragraph from the top of page 7-6, the State of Nebraska has not accepted all conclusions outlined in the paragraph as a finding of fact. It should also be further recognized in the fifth paragraph, that flushing the Guernsey Reservoir also serves to evacuate sediment accumulation from the reservoir.

3) The first paragraph on page 7-10 states that the MRBC plan calls for the construction of three major multi-purpose projects. In this listing the Narrows Unit in Colorado is cited. This is inconsistent with the description of the Narrows Unit found on page 7-18 which indicates construction funds have been deferred pending alternative analysis in F.Y. 80. It is the State of Nebraska's sincere desire to review the alternative analysis before providing further comment on storage projects on the South Platte River.

4) We do question conclusion (a) on page 9-21. This conclusion seems to be inconsistent with the most current planning proposal by the Colorado Fish and Game agency.

5) In Appendix H, page H-33, paragraph 4 indicates that the major problems in Salt Creek are organic pollutants and dissolved solids. We point out that inorganic pollutants resulting from a number of industries in the area have also found their way to Salt Creek.

6) In Appendix H, page H-33, paragraph 6, we would amplify the fact that "The North Platte River below Capser, Wyoming carries excessive TDS and TSS concentrations."

7) In Appendix H, the statement on the top of page H-45 under the sub-heading of Natural Area Preservation, implies policies that do not now exist. A more correct statement of the first sentence would be "River reaches in Kansas and Nebraska need studies in order to quantify their values for recreation and other non-consumptive uses."

This concludes our official review of the Missouri River Basin Water Resources Management Plan and we do not have any comments on the Draft Environmental Impact Statement.

Again, the Nebraska agencies appreciated the opportunity to assist in developing the plan and providing comments.

Sincerely,

CHARLES THONE
Chairman
Interagency Water Coordinating Committee

CT:dwn

STATE OF NORTH DAKOTA

EXECUTIVE OFFICE

BISMARCK

ARTHUR A LINK
Governor

October 10, 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Dr. Hall:

After having staff of the State Water Commission review the Missouri River Basin Water Resources Management Plan report, I am advised that the document is consistent with North Dakota's objectives. It is clear that a great deal of effort has been put into the development of this plan and I would like to commend you and your staff for a job well done.

By organizing the needs of the Missouri River Basin States in a single report, you have facilitated a regional perspective in Water Resource Management. This perspective will ultimately benefit North Dakota through increased understanding and support for needed projects and programs.

Thank you for the opportunity to review this document.

With best regards,

Sincerely yours,

Arthur A. Link

ARTHUR A. LINK
Governor

AAL:nj

STATE OF SOUTH DAKOTA

EXECUTIVE OFFICE

September 8, 1980

Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omana, Nebraska 68114

Dear Mr. Hall:

Thank you for the opportunity to review and comment upon the Missouri River Basin Water Resources Management Plan. The document is a comprehensive review of current planning activities throughout the basin and it will be extremely useful in our ongoing water planning process. Some comments, however, must be made regarding programs which will affect South Dakota.

The Garrison Diversion Unit is one of the recommended programs in the Eastern Dakotas Basin. Because of uncertainties as to the final design of the project, the impacts of the project on South Dakota are not known. I am on record supporting the project providing that assurances are made protecting South Dakota's interests in the areas of water rights, flooding and water quality. We are currently studying the effects of the project and will continue to cooperate with the State of North Dakota and the Water and Power Resources Service in an effort to develop a project which will be acceptable to and benefit both states. At this time, however, I feel it important to make South Dakota's reservations to the currently authorized project known.

The Department of Water and Natural Resources is currently engaged in a study jointly with the U.S. and South Dakota Geological Surveys, the U.S. Environmental Protection Agency, and the East Dakota Conservancy Subdistrict. The study is a water quality analysis of the Big Sioux Aquifer in Eastern South Dakota. While it was begun too late for original inclusion into the report, the study is an important one and should be included in the Management Plan.

The Draft Environmental Impact Statement appears to be a reasonably accurate assessment of the environmental effects of the recommended programs. Nevertheless, while I realize that an in-depth analysis of the effects would require several volumes, the treatment given is somewhat cursory.

Thank you once again for the opportunity to review the plan.

Sincerely yours,

William J. Janklow

WJJ:NRB85510

DEPARTMENT OF AGRICULTURE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20250

Honorable Millard W. Hall
Chairman, Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

September [illegible], 1980

Dear Mr. Chairman:

We have reviewed the May 1980 Missouri River Basin Water Resource Management Plan. It is quite evident that the U.S. Department of Agriculture has worked with the Commission's staff in the preparation of this document. We are pleased to have been a part of this cooperative effort that provides guidance for the development, conservation, preservation, and management of water and related land resources in the Missouri River Basin.

The Purpose of the Plan (page 1-2) states that, "It provides firm direction to agencies...." An alternate rewrite of the second sentence could be: "It provides direction, guidance, and suggestions for further planning to agencies for...." The distinction between these two different perceptions becomes apparent when one considers the relationship of plan "recommendations" to "Federal consistency." Firm implies unlikeliness to change, unyieldingness. The suggested rewrite implies a dynamic plan with latitude for change.

Some editing and status updating suggestions are listed in the enclosure for your consideration.

Sincerely,

Bob Bergland
Secretary
Enclosure

Suggestions for Improving the

May 1980

Missouri River Basin Water Resources Management Plan

1. Page 2-2, Figure 2-1: Clarify by changing title to Major Physiographic Divisions.

2. Page 3-11, paragraph 1: The Timber-Water Management Study is a cooperative U.S. Department of Agriculture (USDA) effort rather than a Soil Conservation Service (SCS) study. Perhaps rewrite as follows: "A USDA cooperative study being completed on a statewide basis, is determining...." Paragraph 3 is redundant.

3. Listing of programs beginning on page 7-11: Updated program status follows.
   a. Page 7-11, item 4: The overland trails Resource Conservation and Development project was not authorized in 1980. It will be considered by Congress again in 1981.

   b. Page 7-13, item 17: The Boulder Valley Center project is not feasible. The application has not been withdrawn.

   c. Page 7-13, item 20: The application for the East Plum watershed projects has been withdrawn.

   d. Page 7-14, item 21: The application for the Evans Watershed project has been withdrawn.

   e. Page 7-14, item 22: The application for the Plum Creek Watershed Project has been withdrawn.

   f. Page 7-19, item 59: The West Canal Watershed project is not feasible; however, the application has not been withdrawn.

4. Listings of programs beginning on page 8-12: Notes follow.
   a. Page 8-12, items 5 and 6: These are Resource Conservation and Development Areas; not Projects.

   b. Page 8-15, item 25: "Cubb" creek should be Cobb Creek.

   c. Page 8-22, item 74: Poney Creek should be Pony Creek.

   d. Page 8-24, insert another item to follow item 91: 92 - Little Sioux Flood Prevention Project
      USDA/SCS
      Flooding, Land Conservation and Management
      Description: Project being developed by using a sub-watershed approach. Sub-watershed status: 84-construction complete, 6-under construction, 10-being planned, and 26-remain to be planned.

5. Page 10-13, item 5: "Project" should be "Area".

6. Page 10-20, insert item to follow 45: Item 78 on page 8-22 should be listed here.

7. Page H-10, Weather Modification: It is uncertain that opportunity exists to provide water at critical periods or to suppress destructive hail.

8. Page H-11, last paragraph: Other North Dakota communities that experience localized flooding are Flasher, Ceter, Kildaire, and Carson.

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, D.C. 20310

7 AUG 1980

REPLY TO
ATTENTION OF

Mr. Millard W. Hall
Chairman, Missouri River
Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

Thank you for your letter of June 2, 1980, to the Secretary of the Army, requesting our comments on the Missouri River Basin Water Resources Management Plan and draft environmental impact statement.

We appreciate the opportunity to review the Management Plan and draft statement and have no comments to offer.

Sincerely,

Michael Blumenfeld
Assistant Secretary of the Army
(Civil Works)

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Policy
Washington D C 20230

September 5, 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle - Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall:

The Missouri River Basin Water Resources Management Plan has been reviewed by this Department and we have no comment pertaining to the Plan.

Sincerely,

Frederick T. Knickerbocker

Frederick T. Knickerbocker
Deputy Assistant Secretary
for Industry Policy

Department Of Energy
Western Area Power Administration
P.O. Box 3402
Golden, Colorado 80401

SEP 15 1980

IN REPLY
REFER TO: A6000

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle, Suite 403
Omaha, NE 68114

Dear Mr. Hall:

Thank you for providing a copy of the May 1980 Missouri River Basin Water Resources Management Plan and draft Environmental Impact Statement (EIS) to Secretary Duncan. We have reviewed the management plan, EIS, appendix G (State Planning Objectives) and appendix H (Water Resources Problems and Opportunities). We have no comments on the management plan and the appendices. We do, however, have some concern about the draft EIS.

We recognize the Commission's responsibility and position regarding development of the Missouri River Basin resources. However, we would like to reiterate that although the draft EIS may be adequate for management plan purposes, it is not adequate for specific projects that are stated in the plan. We assume that the Federal and State agencies who have the direct responsibility of developing such projects will provide specific EIS's in more detail for their respective projects, including cumulative impacts.

We suggest that the above considerations regarding EIS coverage be included in the preface of the management plan so that there is no confusion as to the extent and applicability of the EIS information contained in the body of the plan. If you have any questions about our comments, please let us know.

Sincerely yours,

Robert L. McPhail
Administrator

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VII
324 EAST ELEVENTH STREET
KANSAS CITY, MISSOURI 64106

SEP 22 1980

Dr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403
10050 Regency Circle
Omaha, Nebraska 68114

Dear Chairman Hall:

The following are EPA Region VII and Region VIII comments on the Missouri River Basin Water Resources Management Plan. We understand that the plan has been approved by the Commission and that these comments will be addended to the final document. We would like our comments conditioned by the fact that we recognize the MRBC planning process to be iterative and evolutionary. As such, we propose that our comments be utilized to scope the next revision of this plan.

Comment 1: The plan is described on page 2-30 as "a series of recommended water resource projects, programs, studies and data collection activities which address the Basin's major water resource problems and opportunities within the structure of state planning objectives." This focus limits the document to a compilation of projects. Excluded issues include multi-state development policies, basin-wide problems resulting from earlier water resource development projects or planning for basin development in such a way that recommendations are generated on the basis of sound basinwide policies rather than as the sum of many unrelated projects. The next revision of the water resources plan should be scoped to look synoptically at water resource management problems and opportunities.

Comment 2: Appendix H "Water Resource Problems and Opportunities" contains a review of 14 water resource functions (categories of opportunities and problems) for each subbasin in the Missouri River Basin. EPA is concerned that projects are recommended for funding in each of these water resource functions (categories) without attention to the interrelationships among projects within a single function, and from function to function. Conflicts between the millions of dollars spent on control of water quality problems related to agricultural practices on the one hand and irrigation projects on the other or between irrigation projects and fish and wildlife values are not considered. EPA believes these kinds of issues need to be addressed as part of the next plan revision.

Comment 3: Appendix (A) of the approved plan is a draft Environmental Impact Statement. EPA has commented on the draft EIS as required by the NEPA process. The present EIS is scoped appropriately for the content and depth of analysis of the plan. However, in the future both the plan and Environmental Impact Statement should focus on broad environmental concerns as noted below:

Irrigation

a. What are the effects of successive irrigation developments on nearby non-irrigated farming?

b. What are the effects of new irrigation developments on raising crops elsewhere in the region and elsewhere in the country? Is there a displacement effect?

c. At what point does added irrigation development become infeasible because of limitations of raw water supply? Can Colorado, for example maintain all of its existing agriculture in the face of competing industrial and municipal uses?

d. How much Western agriculture can and should be developed for irrigated agriculture (national perspective)?

Hydroelectric

a. How valuable would new hydroelectric developments be (say for example on the Cache la Poudre) versus the free-flowing status of streams?

b. Given the strong push towards use of existing and new hydro facilities for peaking power, what is the effect of large diurnal flows on riverine systems?

c. What is the long-range potential for use of Missouri River hydro facilities for national peaking power contributions? What are the accompanying long-range environmental impacts of these developments?

Navigation

a. What has been the effect of deepened navigation channels (principally on the Missouri River) in the absence of silt deposition?

b. What recommendations would the Missouri river plan have relative to future navigation on the river?

Flood Control

a. Rivers such as the James in South Dakota have lost a great deal of channel capacity through siltation, principally as a result of farming operations. What combination of structural and nonstructural solutions make the most long-range sense? What approaches will best preserve existing riverine environment?

b. What effects on fisheries will occur through large-scale riprapping of streambanks? What structures are most preferable?

c. Should constraints to floodplain development accompany flood control projects in light of E. O. 11988?

Municipal Supplies

a. What should be the Federal role towards development of municipal water supplies in areas experiencing significant growth problems? How should this investment be coordinated with air pollution programs affected by population growth?

b. What should be Federal policy toward projects that result in prime agricultural land losses?

Industrial Supplies

What should be the Federal role in providing water supplies for new industrial (particularly energy related) developments?

Water Quality

a. Given the massive nonpoint source problems facing agricultural areas, what does the plan recommend in the way of mitigation?

b. What nonpoint source measures should be recommended for reducing salinity in Missouri river streams?

Free-Flowing Rivers and Minimum Stream Flows

a. What recommendations does the plan have for possible additions to the Wild and Scenic River System in view of these recommended water resource projects? In particular, what are the recommendations for protection of free-flowing Missouri river stretches?

b. What recommendations does the plan have for minimum stream flows in various stream segments?

EPA recommends that all these issues be addressed as the plan is revised.

Thank you for the opportunity to comment on this plan. If you have questions regarding our comment, please contact me. The members of my staff most familiar with the project are Jack Bale and Bob Fenemore. They can be reached at (816) 374-6391 or (816) 374-2921 respectively.

Sincerely yours,

Kathleen Q. Camin, Ph.D.
Regional Administrator

U.S. Department of Housing and Urban Development
Office of Regional Administrator

In Reply Refer to:

Regional Office
Professional Building
1103 Grand
Kansas City, Missouri 64106

July 8, 1980

Mr. Millard W. Hall
Chairman
Missouri River Basin Commission
10050 Regency Circle - Suite 403
Omaha, Nebraska 68114

Dear Mr. Hall:

This is in reply to your letter dated June 2, 1980, to Secretary Landrieu requesting comments on the report entitled Missouri River Basin Water Resources Management Plan (May 1980). This letter transmits the official Department of Housing and Urban Development review of the subject report.

The report is generally well prepared and presents a comprehensive guide for the development, conservation, preservation, and management of water and related land resources in the Missouri River Basin.

A minor concern with the report was identified in one planning area. There was only minimal coverage of the integration of water quality programs with water resources programs.

In spite of this identified limitation, the Department has no major substantive concerns regarding the subject study. The report is considered to be acceptable for use in programming, budgeting, and funding water resources programs and projects in the Missouri River Basin.

Departmental comments on the Draft Environmental Impact Statement, Appendix A, will be transmitted separately.

Sincerely,

William O. Anderson
Regional Administrator

KANSAS STATE BOARD OF AGRICULTURE

DIVISION OF WATER RESOURCES
GUY E. GIBSON, Chief Engineer—Director
901 Kansas Avenue
TOPEKA, KANSAS 66612
(913) 296-3717

W. W. DUITSMAN
Secretary

June 26, 1980

Mr. Millard W. Hall, Chairman
Missouri River Basin Commission
Suite 403, 10050 Regency Circle
Omaha, Nebraska 68114

Dear Mr. Hall:

This will acknowledge receipt of the Missouri River Basin Water Resources Management Plan, May 1980, and separate appendices G and H for our review and comment to you.

On Appendix G, Page 56, it states:

> "Where uses conflict, priority of right is as follows: domestic, municipal, irrigation, industrial, recreational, and water power uses."

For your information Kansas Statutes Annotated 82a-707b states:

> "...the date of priority of an appropriation right, and not the purpose of use, determines the right to divert and use water at any time when the supply is not sufficient to satisfy all water rights that attach to it."

I realize it is too late to make corrections in this report. However, should additional copies of this report be printed I am requesting on behalf of the State of Kansas that appropriate corrections be noted regarding the priority to the use of water in the State of Kansas.

Very truly yours,

Guy E. Gibson

Guy E. Gibson - Director
Chief Engineer

GEG:dw

Chairman, Big Blue River
Compact Administration

The Division of Water Resources Deals with Irrigation, Drainage, Flood Control and Related Problems of the Conservation and Utilization of the Water Resources of Kansas

REMARKS AND ACTIONS TAKEN AS A RESULT OF OFFICIAL COMMENTS

State of Colorado

No official comment provided.

State of Iowa

Comments noted; no action required.

State of Kansas

Comments noted; no action required.

State of Minnesota

No official comment provided.

State of Missouri

Comments noted; no action required

State of Montana

No official comment provided.

State of Nebraska

The suggested comments were incorporated into the text of the Water Resources Management Plan.

State of North Dakota

Comments noted; no action required.

State of South Dakota

Comments noted; no action required.

State of Wyoming

No official comment provided.

Department of Agriculture

The suggested comments were incorporated into the text of the Water Resources Management Plan, with the exception of the Little Sioux Flood Prevention Project. An addition to the adopted water resources management plan requires Commission approval.

Department of the Army

Comments noted; no action required.

Department of Commerce

Comments noted; no action required.

Department of Energy

Comments noted; no action required.

Environmental Protection Agency

The suggested comments have been noted and will be considered in future water resources management planning.

Department of Health and Human Service

No official comment provided.

Department of Housing and Urban Development

Comments noted; no action required.

Department of the Interior

No official comment provided.

Department of Transportation

No official comment provided.

Yellowstone River Compact Commission

No official comment provided.

Big Blue River Compact Administration

The suggested comment was incorporated into the text of the Water Resources Management Plan.

International Joint Commission

No official comment provided.